PROJECT MANUAL

MAY 8, 2019

VLK | ARCHITECTS

Smithfield MS - Gymnasium Addition

BIRDVILLE ISD
NORTH RICHLAND HILLS TEXAS

VLK Project No.

1887.00

OWNER:

Birdville Independent School District
6125 East Belknap Street
Haltom City, TX 76117

OWNER

Birdville
Independent School District
6125 East Belknap Street
Haltom City, TX 76117

ARCHITECT

VLK Architects, Inc.
Josseph Durán
2821 West 7th Street, Suite 300
Fort Worth, Texas 76107
Phone: 817.633.1600
www.vlkarchitects.com

05/08/2019

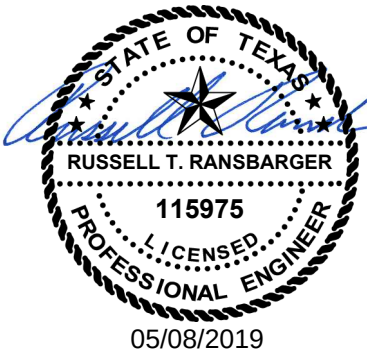
CIVIL ENGINEER

Teague, Nall & Perkins, Inc.
Firm Registration Number F-230
Philip Varughese, P.E.
5237 N. Riverside Drive, Suite 100
Fort Worth, Texas 76137
Phone: 817.336.5773
www.tnpinc.com

05/08/2019

STRUCTURAL ENGINEER

Dunaway Associates
Firm Registration Number: F-1114
Russell Ransbarger, PE
550 Bailey Avenue, Suite 400
Fort Worth, Texas 76107
Phone: 817.335.1121
www.dunawayassociates.com



05/08/2019
TBPE FIRM F-1114

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BIRDVILLE ISD
NORTH RICHLAND HILLS, TEXAS

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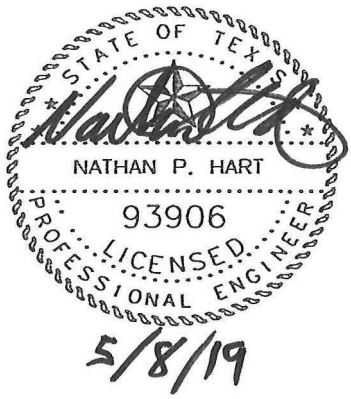
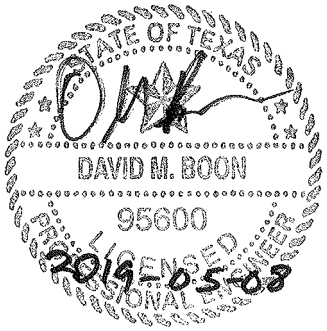
MEP ENGINEER

Reed, Wells, Benson & Co.
Firm Registration Number: F-2176
Nathan P. Hart, P.E.
David Boon, P.E.
12001 North Central Expressway
Suite 1100
Dallas, Texas 75243
Phone: 972.788.4222
www.rwb.net





TECHNOLOGY

Wrightson, Johnson, Haddon and Williams Inc.
Rene Garza
4801 Spring Valley Rd., Suite 113
Dallas, Texas 75244
Phone: 972.934.3700
www.wjhw.com

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DOCUMENT 00 01 10

TABLE OF CONTENTS

05/08/2019

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

PROCUREMENT REQUIREMENTS

Document Birdville ISD Request for Competitive Sealed Proposals (RFCSP)
00 31 32 - Geotechnical Data

CONTRACTING REQUIREMENTS

Document 00 52 00 - Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum - AIA Document A101-2017 (Draft)
- Insurance and Bonds - AIA Document A101-2017 - Exhibit A (Draft)
00 61 13.13 - Performance Bond Form
00 61 13.16 - Payment Bond Form
00 62 00 - Affidavit of Non-Asbestos, Lead, and PCB Use in Project
00 65 00 - Release of Lien Documents
00 70 00 - General Conditions of the Contract for Construction, AIA Document A201-2017 (Modified) (Draft)
00 73 46 - Prevailing Wage Rate Determination Information
00 73 50 - Weather Table

DIVISION 01 - GENERAL REQUIREMENTS

Section 01 11 00 - Summary of Work
01 21 00 - Allowances
01 29 00 - Payment Procedures
01 31 00 - Project Management and Coordination
01 31 19 - Project Meetings
01 31 19.13 - Preconstruction Meetings
01 32 16 - Construction Progress Schedules
01 33 23 - Shop Drawings, Product Data, and Samples
01 35 00 - Alteration Project Procedures
01 41 00 - Regulatory Requirements
01 42 00 - References
01 42 16 - Definitions
01 45 00 - Quality Control
01 45 23 - Testing and Inspection Services (By Owner)
01 50 00 - Temporary Facilities and Controls
01 57 23 - Temporary Storm Water Pollution Control
01 62 00 - Product Options
01 65 00 - Product Delivery Requirements
01 66 00 - Product Storage and Handling Requirements
01 73 29 - Cutting and Patching
01 74 13 - Cleaning
01 77 00 - Closeout Procedures
01 78 23 - Operation and Maintenance Data
01 78 30 - Warranties and Bonds
01 78 39 - Project Record Documents
01 78 40 - Spare Parts, Overages and Maintenance Materials

DIVISION 02 - EXISTING CONDITIONS

Section 02 41 19 - Selective Structure Demolition

05/08/2019

DIVISION 03 - CONCRETE

DIVISION 04 - MASONRY

DIVISION 05 - METALS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

DIVISION 08 - OPENINGS

05/08/2019

DIVISION 09 - FINISHES

DIVISION 10 - SPECIALTIES

DIVISION 11 - EQUIPMENT

DIVISION 12 - FURNISHINGS

DIVISION 13 - SPECIAL CONSTRUCTION

NONE IN THIS PROJECT

DIVISION 14 - CONVEYING EQUIPMENT

NONE IN THIS PROJECT

DIVISIONS 15 through 20 - Not used.

DIVISION 21 - FIRE SUPPRESSION

DIVISION 22 - PLUMBING

05/08/2019

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

Section 23 00 00 - Heating, Ventilating, and Air Conditioning (HVAC) Work
23 05 00 - Common Work Results for HVAC
23 05 13 - Common Motor Requirements for HVAC
23 05 14 - Common Motor Starter Requirements for HVAC Equipment
23 05 15 - Variable Frequency Motor Controllers for HVAC Equipment
23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
23 05 53 - Identification for HVAC Equipment and Piping
23 05 93 - Mechanical Systems Testing, Adjusting, and Balancing (TAB)
23 07 00 - Insulation
23 08 00 - Mechanical Systems Commissioning
23 09 00 - Controls and Instrumentation
23 21 13 - Hydronic Piping
23 23 00 - Refrigerant Piping
23 30 00 - HVAC Air Distribution
23 34 00 - Exhaust and Supply Air Fans
23 43 23 - Polar Ionization Air Purification Systems
23 81 27 - Duct-Free Split Systems
23 81 33 - Semi-Customized Rooftop Air Conditioning Units (Gas - Electric) (3 Tons and Above)
23 82 46 - Electric Unit Heaters

DIVISIONS 24 and 25 - Not used.

DIVISION 26 - ELECTRICAL

Section 26 00 00 - Electrical
26 05 01 - Electrical Demolition
26 05 19 - Low Voltage Electrical Power Conductors and Cables
26 05 20 - Cable Connections
26 05 23 - Control - Voltage Electrical Power Cables
26 05 26 - Grounding and Bonding for Electrical Systems
26 05 29 - Hangers and Supports for Electrical Systems
26 05 32 - Raceways
26 05 33 - Boxes for Electrical Systems
26 05 53 - Identification for Electrical Systems
26 22 13 - Low Voltage Distribution Transformers
26 24 13 - Circuit Breaker Distribution Switchboards
26 24 16 - Panelboards
26 27 16 - Electrical Cabinets and Enclosures
26 51 01 - Interior Lighting
26 51 05 - Lighting Controls
26 51 07 - Emergency Inverters

DIVISION 27 - COMMUNICATIONS

Section 27 10 00 - Structured Cabling System
27 41 16 - Integrated Audio-Video Systems and Equipment
27 50 00 - Distributed Communications and Monitoring Systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

Section 28 05 00 - Common Work Electronic Security
28 05 13 - Conductors and Cables for Electronic Security
28 10 00 - Access Control
28 20 00 - Video Surveillance
28 31 00 - Fire Alarm Systems (Performance Specification)

DIVISIONS 29 and 30 - Not used.

DIVISION 31 - EARTHWORK

05/08/2019

DIVISION 32 - EXTERIOR IMPROVEMENTS

DIVISION 33 - UTILITIES

DIVISIONS 34 through 49 - Not used.

REQUEST FOR COMPETITIVE SEALED PROPOSALS (RFCSP)

Sealed RFCSP's will be received in accordance with the attached specifications. The sealed envelope containing your RFCSP should be plainly marked with the RFCSP title, number, and opening date and time. RFCSP's are publicly opened and you are invited to attend.

PLEASE NOTE: Late RFCSP's WILL NOT be accepted.

Mail or deliver complete RFCSP Packet to:**

Birdville ISD
Purchasing Department
3124 Carson Street, Haltom City, Texas 76117

RFCSP Number: 069-19

RFCSP Title: Smithfield Middle School – Gymnasium Addition

Due Date: June 6, 2019

Time: 2:00pm CST

For additional information, please contact the person listed below. All questions **must be submitted in writing** (email preferred) and received on or before seventy-two (72) hours prior to the opening date. **No verbal responses will be provided.** Please note that RFCSP results are **NOT** available by telephone. Awards will be posted to the district website.

Shelley Freeman
Director of Purchasing
817-547-5629
shelley.freeman@birdvilleschools.net

TABLE OF CONTENTS

SECTION I
GENERAL SPECIFICATIONS

PURPOSE
In order to be in compliance with federal, state and local purchasing laws, the Birdville Independent School District (BISD) is soliciting competitive sealed proposals for a Gymnasium Addition to Smithfield Middle School. The District plans to evaluate responses, select a vendor and enter into a contract with the successful contractor. The estimated budget is $7,700,000.00 with a $400,000.00 contingency.

DISTRICT BACKGROUND INFORMATION
The District currently has twenty-one (21) elementary schools, seven (7) middle schools, four (4) high schools, and one (1) career tech academy.

Birdville ISD is the fifth-largest school district in northeast Tarrant County, with more than 24,300 students. The District's 33 campuses serve the community of Richland Hills and portions of Haltom City, Hurst, North Richland Hills, Watauga, Colleyville and Fort Worth.

Additional information concerning the District may be obtained at www.birdvilleschools.net.

RFCSP PROCESS
Each Proposer shall carefully examine all documents and any and all addenda or other revisions, and thoroughly familiarize with all requirements prior to submitting a proposal. Should a Proposer find discrepancies or ambiguities in, or omissions from, the documents, or should the Proposer be in doubt as to the meaning, the Proposer shall at once (in any event not later than 72 hours prior to the due date) submit to Purchasing a written request for interpretation or correction thereof. The Proposer submitting the request will be responsible for its prompt delivery. Any oral communication by the contact person or designee concerning the RFCSP is not binding and shall in no way modify the RFCSP or the obligation of BISD or Proposer.

CONTRACT ADMINISTRATOR
All communications regarding this RFCSP must be coordinated through the BISD contract administrator. The designated contract administrator during the RFCSP process shall be:

Shelley Freeman
Director of Purchasing
3124 Carson Street
Haltom City, TX 76117

Questions may be sent to Shelley Freeman via email at shelley.freeman@birdvilleschools.net or sent via fax to 817-547-5544. The fax or e-mail must clearly identify the proposer's name and RFCSP number. Any written information given to one proposer concerning a RFCSP will be furnished as an addendum to all proposers who have been issued a RFCSP. All questions and answers will be published and provided to all potential proposers as soon as possible.

Proposer shall have no contact with other District staff or board members without permission from the designated contract administrator. Failure to adhere to this requirement will result in disqualification of the Proposer from further consideration.

UNDERSTANDING OF THE RFCSP

By submitting a signed proposal, a proposer agrees that it fully understands this RFCSP and shall abide by the terms and conditions contained therein. Further, such proposer certifies that it is in compliance with all federal and state laws and purchasing guidelines of the Birdville Independent School District. This includes all requirements as it relates to HB25 which can be found on the https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm. Required forms to be submitted by the proposer are outlined herein. Additionally, proposer certifies that neither proposer, nor any of its employees, agents, or representatives, including any subcontractors and employees, agents, or representatives of such subcontractors, to be assigned to the project hereunder has been convicted of a penal offense, or that, if such a conviction has occurred, proposer will fully advise the Board of Trustees as to the facts and circumstances. Failure to do so may result in disqualification of any subsequent proposal.

No exceptions, amendments, or deviation will be allowed in any response unless agreed to in writing and prior to the date that responses to questions are due. Unauthorized exceptions, amendments, or deviations in the response may result in disqualification of the proposal.

AUTHORIZED SIGNATURE

By signing and executing this proposal the Proposer certifies and represents to the District that the Proposer has not offered, conferred or agreed to confer any pecuniary benefit or other thing of value for the receipt of special treatment, advantage, information, recipient's decision, opinion, recommendation, vote or any other exercise or discretion concerning this RFCSP. Proposals must show Proposer name and address of Proposer and be manually signed. Failure to do so will disqualify proposal. Person signing proposal must show title or AUTHORITY TO BIND THE PROPOSER IN A CONTRACT.

RESPONSE FORMS

This RFCSP contains forms that are required to be completed and submitted along with your response. Failure to complete and submit these forms may render your proposal non-responsive. BISD may, if the form is not required to evaluate the responses, waive this requirement and have the forms signed after proposal at the sole discretion of BISD. Signing after the submission date has expired is only permissible if doing so cannot alter the evaluation scoring or does not prejudice another offer.

ADDENDA

Receipt of an Addendum must be acknowledged by signing and returning the Addendum with the RFCSP, if requested, or under separate cover prior to the due date. The Addenda containing proposal pricing should be returned in a sealed envelope marked on the outside with the Proposer's name, address, RFCSP number, and due date and time. Addenda will be posted to the Birdville ISD Purchasing website. It is the responsibility of each Proposer to obtain all addenda that pertains to this RFCSP. **Proposers who fail to check the website and submit a RFCSP without acknowledging receipt of all addenda issued may be deemed to have submitted a RFCSP not responsive to this solicitation.** Failure to receive such addenda does not relieve Proposer from any obligation under the RFCSP submitted. All formal written addenda become a part of the RFCSP documents. Proposers shall acknowledge receipt of all addenda in the RFCSP Response Form.

PROPOSAL SUBMISSION

RFCSP's must be received in the Purchasing Department **prior to** the hour and date specified in this document or any subsequent Addenda. No other published dates will be binding. The clock located in the Birdville ISD Purchasing Department is considered the official time for receiving and opening RFCSP's. It is the sole responsibility of the Proposer to ensure timely delivery of the RFCSP. BISD will not be responsible for failure of service on the part of the U.S. Postal Office, courier companies, or any other form of delivery chosen by the Proposer.

Proposers submitting RFCSP's to BISD do so at their own expense. BISD will not be held responsible for any cost associated with the process by submitting Proposers.

Please make note of our office hours (Monday thru Thursday - 8:00 AM to 4:30 PM and Friday- 8:00 AM to 4:00 PM). District offices are closed Fridays during the summer.

Late proposals will not be accepted. No verbal, telephonic, electronic mail, or faxed RFCSP's will be considered. RFCSP's received after the date and time specified **will not** be considered. The Purchasing Department will notify those Proposers submitting late RFCSP's and will hold documents for pick-up for five (5) business days following late RFCSP notification. **All late RFCSP's which are not picked up by the Proposer within five business days will be discarded.**

One (1) original and two (2) copies of the RFCSP must be sealed in an ***envelope clearly marked with closing date, company name and "RFCSP Enclosed #069-19"*** and addressed to the Purchasing Department, Birdville Independent School District, 3124 Carson Street, Haltom City, Texas 76117.

RESERVATIONS

The School District expressly reserves the right to:

1. Specify approximate quantities;
2. Extend the opening date and time;
3. Consider and accept alternates, if specified in the documents, when most advantageous to the School District;
4. Waive as an informality, minor deviations from specifications, provided they do not affect competition or result in functionally unacceptable goods or services;
5. Waive any minor informality in any RFCSP or procedure (A minor informality is one that does not affect the competitiveness of the Proposer);
6. Add additional terms or modify existing terms in the proposal;
7. Reject a proposal because of unbalanced unit proposal prices;
8. Reject or cancel any or all RFCSP's;
9. Reissue a RFCSP; and/or
10. Procure any item by other means.

SITE VISIT

During the proposal process, the contractor may request to conduct a site visit to become familiar with the physical location and access the delivery conditions. Site visits may be coordinated by contacting Conan Mathson at 817-547-5851

QUALITY OF MATERIAL

Any item that does not perform or meet tests as specified by the seller shall be replaced by the Proposer at no cost to the District.

ALTERNATE

Proposers may offer an "equal" product as an alternate. Final "approved equal" determination remains with the School District.

BRAND NAME OR EQUAL

If the proposal indicates brand name or "equal" products are acceptable; the Proposer may propose an "equal" product but must be prepared to demonstrate those features that render it equal. Final determination of a product as an "equal" solely remains with the District. The District may deem it necessary to specify Brand Name Only, "No Substitutes," after conclusive testing, prior usage or standardization.

NEW MATERIAL
Unless otherwise stated in the specifications, all supplies and components to be provided under this RFCSP shall be new (not used or reconditioned, and not of such age or so deteriorated as to impair their usefulness or safety), of current production, and of the most suitable grade for the purpose intended. If at any time during the performance of this RFCSP the Proposer believes that the furnishing of supplies or components which are not new is necessary or desirable, it shall notify the District immediately, in writing, including the reasons and proposing any consideration which will flow to the District if authorization to use such supplies or components is granted.

SAMPLES
Samples and/or product specification documents may be required for items. Product specification shall be submitted with the RFCSP, properly referenced and clearly marked so as to indicate related RFCSP item. Samples, when requested, must be furnished at no cost to the District and will not be returned. Each sample should be clearly marked with bidders/proposer's name, RFCSP number, and item number on the RFCSP. **DO NOT ENCLOSE IN OR ATTACH RFCSP TO SAMPLE.** Birdville ISD assumes no responsibility for the handling of samples in any manner. Improperly identified samples will not be considered.

When samples and/or product specifications are not required to be submitted, Birdville ISD reserves the right to request samples and/or product specification documents for any merchandise submitted for RFCSP before final selections are made. Samples and/or product specifications requested after RFCSP opening must be received within five (5) calendar days after request.

SUITABILITY FOR INTENDED USE
All chemicals must be certified lead free, non-toxic and will require a MSD sheet (chemicals defined as paints, lacquers, thinners, caulks, fillers, etc.). This documentation must be provided at time of purchase, before payment is approved. All other supply items should be comparable in quality and intended use. Suitability for intended use: (paints, pastes, inks, chemicals, markers, etc.) MSD sheet should clearly indicate item number.

RIGHT TO AMEND OR WITHDRAW RFCSP
The District reserves the right to alter, amend, or modify any provisions of this RFCSP, or to withdraw this RFCSP, at any time prior to the award of the contract pursuant hereto, if it is in the best interest of the District to do so.

The Proposer CANNOT alter or amend the RFCSP after the closing. Alterations made before the closing must be initiated by proposer, guaranteeing authenticity and approved in writing by the Director of Purchasing.

REJECTION OF RFCSP
BISD reserves the right to accept or reject in part or in whole any proposal submitted, and to waive any technicalities for the best interest of the School District.

RFCSP's may be rejected, among other reasons, for any of the following specific reasons:

A. RFCSP received after the time limit for receiving bids as stated in the advertisement
B. RFCSP containing any irregularities
C. Unbalanced value of any items
D. Improper or insufficient RFCSP guaranty, if required
E. Where the Proposer, any Sub-Proposer or Supplier, or the surety on any bond given, or to be given, is in litigation with the District or where such litigation is contemplated or imminent, in the sole opinion of the District

DISQUALIFICATION OF PROPOSERS

Proposers may be disqualified and their RFCSP's not considered, among other reasons, for any of the following specific reasons:

A. Reason for believing collusion exists among the Proposers
B. Where the Proposer, any Sub-Proposer or Supplier, or the surety on any bond given, or to be given, is in litigation with the District or where such litigation is contemplated or imminent, in the sole opinion of the District
C. The Proposer being in arrears on any existing Contract/Purchase Order or having defaulted on a previous Purchase Order
D. Lack of competency as revealed by pertinent factors, including but not necessarily limited to, experience and equipment, financial statement and questionnaires
E. Uncompleted work that in the judgment of the District will prevent or hinder the prompt completion of additional work if awarded
F. Where the Proposer has failed to perform in a satisfactory manner on a previous Purchase Order/Contract

ASSURANCES

Proposers (owners, officers, employees, volunteers, etc.) may not work on district property where students may or may not be present when they have charges pending, have been convicted, received probation or deferred adjudication for the following:

A. Any offense against a child
B. Any sex offense
C. Any crimes against persons involving weapons or violence
D. Any felony offense involving controlled substances
E. Any felony offense against property
F. Any other offense the District believes might compromise the safety of students, staff, or property

CRIMINAL HISTORY CHECKS AND BADGING REQUIREMENTS

During the term of this agreement, the proposer's employees have access to Birdville ISD facilities while students are present which could result in contact with students. Subsequently, the proposer is responsible for complying with Texas Education Code § 22.0834. The various levels of criminal history and badging requirements are described below:

A. All proposers who will only deliver to the front office, but not enter a school building to perform service will be required to complete Form J and submit the Certification for Criminal History Check Form with their proposal.

B. For all proposers who perform service within the school buildings, but do not involve direct and ongoing contact with students, the proposer is instructed to follow the procedures as outlined for obtaining badging through FC Background. FC Background is an independent firm selected to perform criminal history checks for the Birdville ISD contractors and vendors who do not have direct and ongoing contact with students. In addition to FC Background's badging process, the proposer is responsible for ensuring direct access to students is prohibited. The proposer and all workers on Birdville ISD property will enforce compliance and shall certify compliance with Texas Education Code § 22.0834, see Form J. As a minimum the contractor/vendor is responsible for the following:
    1. Contractor/vendor shall only use restrooms designated for contractors/workers. Student restrooms are prohibited from use. The following are the only facilities for use:
        a. Inside Birdville ISD buildings, "faculty only" facilities, if necessary, with preference for contractors to use contractor furnished "portable" facilities;
        b. Outside Birdville ISD property, contractor/vendor furnished "portable" facilities.

2. Proposers are not allowed direct and ongoing unsupervised contact with students in areas including, but not limited to: classrooms, elevators, athletic buildings, weight rooms, gymnasiums, auditorium, practice rooms, band halls, hallways, locker rooms, office spaces where students are located.

3. Precautions listed in this section are minimal requirements to avoid direct and unsupervised contact with students. The successful proposer is responsible for implementing additional measures to ensure direct and ongoing unsupervised contact with a student does not exist.

4. The company recommended for award shall complete the background screening and badging process with FC Background to have all employees and sub-contractors working on-site for Birdville ISD. All costs associated with badging are the responsibility of the successful proposer.
    a. FC Background Information:
        i. FC Background
        Phone 972-404-4479 Fax 214-306-8207
        Monday-Friday 6am – 6pm (CST)
        Customer.support@fcbackground.com
        ii. Facility maps are available on www.fcbackgbround.com
        iii. Cost per employee is $30.00 per subject (additional criminal records search fees may apply)
    b. Birdville ISD Badging Qualifications:
        i. No felony convictions, no open or pending felony cases (no limit);
        ii. No misdemeanor convictions involving crimes against children or crimes of moral turpitude;
        iii. No registered sex offenders; or
        iv. No outstanding warrants for crimes that would disqualify an individual from receiving a badge.
5. If at any time a contractor finds themselves with direct and ongoing unsupervised contact, they should report to the administrator on duty and remove themselves from the service until requirements listed in section C can be completed.

C. For all proposers who perform service where there is direct and ongoing unsupervised contact with students(s) Form N shall be completed and proposer shall comply with the following:
1. Individuals
    a. Obtain a required criminal history record information through the Department of Public Safety's Fingerprint-based Applicant Clearinghouse of Texas (FACT), regarding its employees assigned to work on Birdville ISD premises. The following steps should be followed to complete this process:
        i. If you are an individual/sole proprietor (one-person company) you must contact Birdville ISD Shelley Freeman at shelley.freeman@birdvilleschools.net to obtain a FAST pass.
        ii. Follow instructions on the FAST Pass to arrange an appointment to be finger printed. Contractor may select the most convenient location in their zip code.
        iii. After fingerprinting is completed, email Shelley Freeman, Director of Purchasing at shelley.freeman@birdvilleschools.net and provide the following: RFCSP number, full name and date of birth date for person assigned to work on site during the contract term. If it is not possible to verify an employee based on the name and date of birth, it may be necessary to provide a driver's license number or state identification card.
2. Contractor Personnel
    a. For all contractors/vendors/subcontractors who will have direct and ongoing unsupervised contact with students(s) and have multiple personnel working for that contractor, the following will apply.

i. Awarded contractor/vendor/subcontractor will receive an award letter from Birdville ISD and/or contract from the general contractor prior to contact the Department of Public Safety.
ii. Contact the Department of Public Safety at 512-424-2474. Select option 2 to establish a vendor account and obtain a FAST Pass. This process can take up to seven to ten business days.
iii. Follow instructions on the FAST Pass to arrange an appointment for employees to be finger printed. Employers may select the most convenient location based on your zip code.
iv. After fingerprinting is completed, email Shelley Freeman, Director of Purchasing at shelley.freeman@birdvilleschools.net and provide the following: RFCSP number, full name and date of birth for all personnel assigned to work on site during the contract term. If it is not possible to verify an employee based on the name and date of birth, it may be necessary to provide a driver's license number or state identification card.
v. If an employee is arrested while under contract, the contractor must contact Shelley Freeman, Director of Purchasing, at 817-547-5626 immediately. The incident must be reported within three (3) business days of the arrest. The employee shall be removed from work on Birdville ISD for the duration of the contract. Failure to do so will make the contract null and void.

CONFLICT OF INTEREST

Each proposer must disclose any existing or potential conflict of interest relative to the performance of the requirements of this RFCSP. Examples of potential conflicts may include an existing business or personal relationship between the proposer, its principal, or any affiliate or subcontractor, with the District or any other entity or person involved in any way in the project that is the subject of the RFCSP.

Similarly, any personal or business relationship between the proposer, the principals, or any affiliate or subcontractor, with any employee of the District or its suppliers must be disclosed. Any such relationship that might be perceived or represented as a conflict should be disclosed. Failure to disclose any such relationship or reveal personal relationships with district employees may be cause for contract termination. The District will decide if an actual or perceived conflict should result in proposal disqualification.

By submitting a proposal in response to this RFCSP, all proposers that they have not given, nor intend to give, at any time hereafter any economic opportunity, future employment, gift, loan, gratuity, social discount, trip, favor, or service to a board member, a public servant or any employee or representative of the District, in connection with this procurement. The CONFLICT OF INTEREST QUESTIONNAIRE is included in this specification. For further information, a proposer can review the requirements as provided under HB 1491.

SELECTION PROCESS

The District's Selection Committee will evaluate and rank each submittal in relation to the selection criteria described in the RFCSP. Only those receiving the highest scores on the analysis may be interviewed or contacted for further information. Negotiations with the selected Proposer may cover scope of work, contract schedule, contract terms and conditions, technical specifications, level of effort and price.

The award of the contract will be to the responsible Proposer whose proposal is deemed to be the best and whose proposal best meets the needs of the school district.

A responsive proposer shall have submitted a complete sealed proposal packet within the stated timeline and in accordance with the proposal specifications. A responsible proposer shall demonstrate the ability to successfully deliver the supplies, equipment and/or services being procured.

Results will become available after approval by the Board of Trustees.

SELECTION CRITERIA

The District reserves the right to award this RFCSP to a single Proposer, multiple Proposers, each line item separately, or in any combination it determines to be in the best interest of the District. If the Proposer chooses to bid/propose "all or none" or is not agreeable to multiple or split awards, it must be noted on the Deviation/Compliance Form and included with the RFCSP.

RFCSP's must remain open for acceptance for a period of **ninety (90) days** subsequent to the opening of RFCSP's, unless otherwise indicated, to allow time for the offer(s) to be evaluated and Board of Trustees action, if required.

Regardless of the award of RFCSP hereunder, the District retains the right to purchase the same or similar materials or items from other sources should it be determined that doing so would be in the District's best interest. Based upon the proposal material submitted, the following criteria will be used in evaluation.

Extensions of unit prices shown will be subject to verification by the district. In case of variation between the unit price and the extension, the unit price will be considered to be the proposal.

Per Texas Education Code, Subchapter B, Sec. 44.031(b) *ALL CONTENTS PROVIDED IN THIS SOLICITATION, WILL BE CONSIDERED AS AN EVALUATION FACTOR

EVALUATION FACTORS		PERCENTAGE OF POINTS
A.	The Purchase Price - Fees and Associated Costs	51%
B.	The reputation of the Proposer and the Proposer's goods or services – Based on demonstrated expertise and experience; references (availability of contract items, reliability of deliveries, condition of delivered product and wholesomeness, accurate invoices)	20%
C.	The quality of the Proposer's goods or services – ability to perform all requirements and unique abilities of the Proposer	10%
D.	The extent to which the services meet the district's needs (based on ability to meet delivery schedule, lead time for orders, offer products specified)	5%
E.	The Proposer's past relationship with the District	5%
F.	The impact on the ability of the district to comply with laws and rules relating to historically underutilized businesses; (1 point given for completion of form) "Federal Requirements for Procurement and Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms."	1%
G.	The total long term cost to the District to acquire the Proposer's goods or services	0%
H.	For a contract for goods and services, other than goods and services related to telecommunications and information services, building construction and maintenance, or instructional materials, whether the Proposer or the Proposer's ultimate parent company or majority owner: a. has its principal place of business in this state; or b. employs at least 500 persons in this state (Form E)	0%
I.	Any other relevant factor specifically listed in the request for bids or proposals a. Schedule	8%

TIME LINE FOR RFCSP
Subject to change if in the best interest of the district.

RFCSP Release Date	**May 9, 2019**
Advertising Dates	**May 10, 2019 and May 17, 2019**
Pre-Proposal Meeting	**NONE SCHEDULED**
Deadline for Questions and Clarifications	**May 30, 2019 at 10:00 am CST**
Due Date	**June 6, 2019 at 2:00 pm CST**
Board Approval Date	**June 20, 2019**

CONTRACT
The proposal document, addenda and any negotiated documents, returned and awarded by the Birdville ISD shall constitute the contract. The contract will be put into effect by means of executed purchase order(s) after proposals have been awarded unless otherwise specified.

CONTRACT TERM
This proposal shall be effective upon School Board approval until completion of the project.

OPEN RECORDS
Following the award of a contract, responses to this RFCSP are subject to release as public information unless the response or specific parts of the response can be shown to be exempt from the Texas Open Records Act. Proposers are advised to consult with their legal counsel regarding disclosure issues and take the appropriate precautions to safeguard trade secrets or any other proprietary information. The District assumes no obligation or responsibility for asserting legal arguments on behalf of potential proposers.

If a proposer believes that a proposal or part(s) of a proposal is confidential, then the proposer must so specify. The proposer must stamp in bold red letters the term 'CONFIDENTIAL' on that part of the proposal which the proposer believes to be confidential. The proposer must submit in writing specific detailed reasons, including any relevant legal authority, stating why the proposer believes the material to be confidential. Vague and general claims as to confidentiality will not be accepted. The District will be the sole judge as to whether a claim is general and/or vague in nature.

ASBESTOS
Proposers who perform work inside the Birdville ISD facilities are hereby notified that our buildings may contain asbestos containing materials. This notification is required by both the State of Texas Department of State Health Services and the Federal EPA Asbestos regulations. These guidelines cover both Birdville ISD's responsibilities and the Employer's responsibility to their employees. As a Proposer it is your responsibility to check each building prior to performing any work in that facility. These building materials may include but are not limited to: ceiling tile, floor tile and mastic, sheetrock, tape and bed compound, thermal pipe insulation, spray-on ceiling material, calks, and roofing products. As there have been numerous asbestos containing products manufactured over the years, you must check each building's Asbestos Management Plan. This plan is normally kept in the main office. Check with the school secretary and she will allow you to look at it. It is the Proposer's responsibility to notify all employees working for them that Birdville ISD facilities may contain asbestos and where their employees may find the facility's Asbestos Management Plan. Again, it is the Proposer's responsibility to check the Asbestos Management Plan for each facility prior to working in the facility and then to notify their employees performing the actual work. The information is found in section eight (8) for all asbestos that are remaining in the building. If after looking in the Asbestos Management Plan you are uncertain about whether the area you will be working in contains asbestos or not, please contact the Environmental Department at 817-871-3300 for further assistance.

QUANTITIES
RFCSP's must be submitted on units of quantity specified. Any suggestions as to quantity to secure a better price are welcome. The quantities appearing in this RFCSP are approximate only, and the District reserves the right to increase, decrease or delete any or all items. If the quantities of materials to be furnished are increased, such increase shall be paid for according to the unit prices established for the item. The successful Proposer shall have no claims against the District for anticipated profits for the quantities called for, diminished or deleted. Estimated quantity change of products on bid shall be no more than 25% as is the statutory change order amount in Texas law.

DELIVERY OF GOODS
A specific delivery date may be required to be a part of each RFCSP. The District considers delivery time to be that period elapsing from the time the individual order is placed until that order or work thereunder is received by the District at the specified delivery location.

All items covered by this RFCSP shall be delivered F.O.B Destination to Birdville ISD, from point of assembly to the District location(s) specified on each purchase order. **RFCSP pricing shall include all freight/delivery charges.** The District shall not be liable for any deliveries of merchandise unless same has been received at the specified delivery location within the Birdville ISD, inspected and accepted as in full compliance with the Specifications. Risk of theft, destruction, loss or damage to any work, materials, shipment, or deliveries will be borne exclusively by the successful Proposer until after the District completes its inspection and acceptance of said work, material, shipments, or deliveries; the burden and cost of insurance against such risks shall be assumed by the successful Proposer.

Deliveries will be made only upon authorization of the Birdville ISD, and shall be made if, as, and when required and ordered by the District, at such intervals as directed by the District. It is important that each supplier understand the following information:

- All purchases made by the District will be made via Birdville ISD purchase order.
- Do not provide goods/services absent a bona fide, signed purchase order.
- Do not provide goods/services exceeding the quantities contained on the purchase order.
- The District will only pay invoices which match the purchase order description, quantity, and price.

Deliveries shall be to the location identified in each purchase order. Each proof of delivery shall list the Birdville ISD purchase order number, exact quantity delivered, back orders (if any) and number of pallets.

Proposer warrants that all deliveries made under the purchase order will be of the type and quality specified; and the District may reject and/or refuse any delivery that falls below the quality specified in the Specifications. The District shall not be held to have accepted any delivery until after an inspection of same has been made and an opportunity to exercise its right of rejection has been afforded.

Failure by the Proposer to make reasonable delivery as and when requested shall entitle the District to acquire quantities from alternate sources wherever available, with the right to seek reimbursement from the Proposer for amounts, if any, paid by the District over and above the RFCSP price.

All materials delivered shall be free of any and all liens and shall upon acceptance thereof become the property of the District, free and clear of any liens.

Acceptance by the District of any delivery shall not relieve the Proposer of any guarantee or warranty, express or implied, nor shall it be considered an acceptance of material not in accordance with the Specifications and shall not waive the District's right to request replacement of defective material.

ADDITION OR DELETION OF LOCATIONS
The District, by written notice at any time during the term of the contract, may add or delete locations as deemed necessary. Any such written notice shall take effect on the date stated in the notice from the District. Any added or deleted items will be reflected in the cost in accordance with the proposal unit price for that location. The District shall determine if any adjustments are needed to the proposed schedule and shall provide any changes in writing to the Contractor.

SUBCONTRACTORS
The Contractor will not subcontract or enter into any subcontracting agreements pertaining to this contract, without obtaining approval from the Purchasing Department. If you are subcontracting any part of this contract, the following must be provided: name(s) of the subcontractor(s), addresses, points of contact and phone numbers.

In no event will any subcontracting by the Contractor relieve the Contractor from any of the obligations or conditions of this contract. As between the parties hereto, any of the Contractor's subcontractors will be considered the agent and employee of the Contractor, and the acts or omission of the subcontractors and any person directly or indirectly acting for them will be deemed to be the acts or omission of the Contractor, and the Contractor will remain liable and responsible to the District as if no subcontract had been made. All submittals required of the Contractor shall also be required of any subcontractors.

CANCELLATION
The District shall not pay for services or supplies that are deemed by BISD to be unsatisfactory. Proposers will be given reasonable opportunity, before termination, to correct any deficiencies; however, this in no way may be construed as negating the basis for cancellation. The District reserves the right to cancel the contract, without cause, upon thirty (30) days' written notice.

Birdville ISD reserves the right to cancel the entire contract and/or buy in the open market at the current price and charge the vendor the difference between the price so paid and the proposal in the following events:

a. Brands of merchandise other than brands name on the proposal are delivered without prior approval.
b. Formulation of the product is changed and the district is not contacted for prior approval.
c. Orders are not delivered within the specified time period.
d. Pack changes in which written notification has not been made at least two weeks prior to the delivery.
e. In the case that the product deviates from the specification or is found to be inferior or not wholesome.

WARRANTY INFORMATION
Any information regarding warranties and/or maintenance agreements pertaining to said item(s) are to be included in the proposal.

Warranty – Product: Manufacturers' standard warranty for parts and labor must be included in the prices bid/proposed and must meet or exceed any additional warranty requirements specified herein. All manufacturers' warranties shall be enforced to benefit the District, and replacement of defective materials shall be made promptly upon request.

Warranty – Price: The price to be paid by the District shall be that contained in Seller's RFCSP which Seller warrants to be no higher than Seller's current prices on orders by others for products of the kind and specification covered by this RFCSP for similar quantities under similar or like conditions and methods of purchase. In the event Seller breaches this warranty, the prices of the items shall be reduced to the Seller's current prices on orders by others. Or in the alternative, the District may cancel the Purchase Order(s) without liability to seller for breach of Seller's actual expense.

Warranty – Safety: Seller warrants that the product sold to the District shall conform to the standards promulgated by the U.S. Department of Labor under the Occupational Safety and Health Act of 1970. In the event the product does not conform to OSHA standards, the District may return the product for correction or replacement at the Seller's expense. In the event Seller fails to make the appropriate correction within a reasonable time, correction made by the District will be at Seller's expense.

INSURANCE REQUIREMENTS

These requirements apply to all non-Capital Improvement Program construction projects and to the other bids/proposals as required. The successful Proposer will submit the following Certificates of Insurance naming the Birdville ISD as Certificate Holder and named additional insured on General Liability Certificates. Certificates may be faxed to Birdville ISD, Purchasing Department at 817-831-5662 or emailed to shelley.freeman@birdvilleschools.net. The selected Proposer will be required to supply the insurance certificate(s) prior to the start of the project. The selected Proposer agrees to provide insurance policies or contracts for insurance, when requested, in addition to Certificates of Insurance. **The District reserves the right to require higher limits of coverage depending on the size, scope, and nature of a RFCSP.**

The Proposer shall agree to waive all right of subrogation against the District, its officials, employees and volunteers for losses arising from work performed by the contractor for the District.

INSURANCE REQUIREMENTS ARE AS OUTLINED IN AIA DOCUMENT A101-2017 EXHIBIT A, WHICH IS INCLUDED IN DRAFT FORM IN THIS RFCSP

BID SECURITY REQUIREMENT

RFCSP's shall be accompanied by either an **original** cashier's check, certified check, or money order upon a state bank in the amount not less than five percent (5%) of the total maximum RFCSP price payable without recourse to the Birdville ISD, or an **original** bid bond in the same amount from a reliable surety company licensed to do business in the State of Texas. Bid Security serves as a guarantee that the Proposer will enter into a contract and execute a payment and performance bond on any or all projects $25,000 or above within fifteen (15) days after notice of award.

PAYMENT BOND

For projects in excess of $25,000, an **original** payment bond will be required of the successful Proposer and shall be executed by a surety company acceptable to the District and authorized to do business in Texas. The payment bond shall be in an amount equal to one hundred percent (100%) of the total sum for all projects in excess of $25,000. **Original** bonds shall be delivered to the District no later than fifteen (15) days after receiving the notice of award.

PERFORMANCE BOND

For projects in excess of $100,000, BOTH an **original** performance bond and an **original** payment bond will be required of the successful Proposer and shall be executed by a surety company acceptable to the District and authorized to do business in the State of Texas. The performance and payment bond shall be in an amount equal to one hundred percent (100%) of the total sum for all projects in excess of $100,000. Failure to deliver the performance bond and payment as specified shall be considered as having abandoned the contract and the bid bond will be retained by the District as liquidated damages. **Original** bonds shall be delivered to the District no later than fifteen (15) days after receiving the notice of award.

PROPOSER PRICES

Proposal prices must be firm for the duration of the contract, unless other time stipulations are noted elsewhere in the Special Conditions and Instructions as listed in the package.

PROCUREMENT CARD ORDERING CAPABILITY

The District may, at their discretion, elect to use a MasterCard Procurement Card to procure goods in lieu of a Purchase Order for payment resulting from the award of this contract.

TAXES
The Birdville Independent School District is exempt from Federal Excise, State Sales and Transportation Taxes. TAX MUST NOT BE INCLUDED IN RFCSP. Birdville ISD Federal ID Number is 75-6000193. Tax exemption certificates will be executed by the District upon request.

INVOICING
Pay applications shall be submitted to the Architect for review and approval per SECTION 01 29 00 - PAYMENT PROCEDURES. Pay applications will then be forwarded to Birdville ISD by the Architect.

PROTEST PROCEDURES FOR VENDOR/PROPOSER PROTESTS
Vendors/proposers are encouraged to discuss purchasing concerns with the Director of Purchasing. Concerns should be expressed as soon as possible to allow for early resolution at the lowest possible administrative level.

If a vendor desires to protest a decision by Birdville ISD Purchasing Department, the vendor must submit a letter notifying of the intent to protest and include in the letter the reason for the protest along with any evidence available supporting the vendor's position. Submit the letter to: Birdville ISD Purchasing Department, 3124 Carson Street, Haltom City, TX 76117.

The Director shall respond to the vendor within fifteen (15) business days from receipt with an explanation or offer a compromise. If the vendor is not satisfied, the vendor may submit a formal complaint under Board Policy GF (LOCAL).

Even after initiating a formal complaint process, individuals are encouraged to seek informal resolution of their concerns. An individual whose concerns are resolved may withdraw a formal complaint at any time.

SECTION II
SCOPE OF WORK

SCOPE OF SERVICES

GENERAL REQUIREMENTS FOR CONTRACTORS

1. Contractor personnel shall be clean in appearance and in uniform for easy identification on BISD premises.

2. Contractor will interview, screen, hire, control, supervise, train and pay for sufficient qualified personnel as may be necessary to perform the services contained herein. A criminal history check is required.

3. Contractor shall thoroughly investigate the background of each employee assigned to the BISD property and shall not assign any employee on full or part-time basis who has been convicted of a felony or crime involving moral turpitude or any relationship with a child.

4. Contractor shall be responsible for all materials delivered to the job site. Contractor shall store materials in a secure location to prevent injury from any district staff or students.

5. The use of tobacco and alcohol is prohibited on BISD property.

6. Successful contractor is responsible for any damages done to the ceilings, walls, etc. due to negligence.

7. Proposals will be considered from contractors who are experienced in generator installation.

8. Contractor is responsible for verifying exact specifications prior to submitting proposal.

9. Contractor shall agree to rework any defective workmanship during one (1) year warranty period following original installation at no charge to the District.

SPECIFICATIONS OF WORK

Refer to Project Manual, trade specifications and drawings attached herein for all work and products required for turnkey project.

PROPOSER'S
RETURN PACKET

SECTION III
COVER PAGE

RFCSP: #069-19
SMITHFIELD MIDDLE SCHOOL – GYMNASIUM ADDITION

DUE DATE: JUNE 6, 2019
TIME: 2:00 pm CST

PROPOSER IDENTIFICATION: (*Please print information clearly.)*

Company Name:		**Date:**	
Address:		**Phone:**	
		Fax:	
City/St/Zip		**Email:**	

I hereby acknowledge receipt of the following addenda (if applicable) which have been issued and incorporated into the RFCSP Document. (Please initial in ink beside each addendum received.)

Addendum No. 1		**Addendum No. 3**	
Addendum No. 2		**Addendum No. 4**	

SECTION III
PROPOSAL PRICING

Company Name _____

Item No.	Item Description	Project Cost	Contingency Allowance
1	Base Proposal	$_____	$400,000.00
Total Lump Sum Proposal (Include contingency calculated amount)			**$_____**
Total Lump Sum Proposal **(Include alternate and contingency calculated amount)**			**$_____**

The Proposer agrees, if this proposal is accepted, to commence work on or before a date to be established in the written "Notice-to-Proceed" of the Owner and to attain substantial completion of all Work within _____ consecutive calendar days, subject to extensions of time as described in Article 8.3 of the General Conditions.

SECTION IV
RFCSP RESPONSE CHECKLIST

To be considered for award of **this** solicitation, all pages contained in the "Packet" (including but not limited to forms A – J, the Cover Page, plus any/all attachments, must be completed with all requested information, **SIGNED** and **RETURNED** in a sealed envelope or other appropriate package adequate to conceal and contain the contents prior to the RFCSP date and time. Each RFCSP shall be placed in a separate envelope and properly identified with the RFCSP Number, RFCSP Title, Name of Company submitting RFCSP, and the established time and date to be opened.

Please verify that the documents listed below have been completed, signed, and included in your RFCSP prior to submittal. **TO BE CONSIDERED FOR AWARD, ALL MANDATORY FORMS *MUST* BE COMPLETED, SIGNED AND RETURNED WITH THIS SOLICITATION.**

Mandatory Forms (required to be considered for the Award of this solicitation):

- ☐ Proposer Return Packet and Addendum(s) (Submittals as detailed in the specifications)
  - Insurance
  - References
- ☐ Completed – Packet Cover Page
- ☐ Completed – Proposer Information Response Form – Form A
- ☐ Completed – Deviation/Compliance Signature Form – Form B
- ☐ Completed – Non-Collusion Statement – Form C
- ☐ Completed – Criminal Background Check and Felony Conviction Notification – Form D
- ☐ Completed – Resident/Nonresident Bidder's Certification – Form E
- ☐ Completed – References – Form F
- ☐ Completed – Senate Bill 9 Proposer Certification – Form G
  Not required for this proposal.
- ☐ Completed – Conflict of Interest Questionnaire – Form H
- ☐ Completed – Historically Underutilized Business (HUB) Certification – Form I
- ☐ Completed – Certification for Criminal History Check – Form J
- ☐ Completed –W-9, Tax Payer Identification Number & Certification (not included in packet)

The undersigned, in submitting this RFCSP and endorsement of same, represents that he/she is authorized to obligate his/her Proposer, that he/she is an equal opportunity employer and will not discriminate with regard to race, color, religion, national origin, sexual orientation, or age or disability unrelated to job performance of this RFCSP; and that he/she has read this entire RFCSP package and are aware of the covenants contained herein and will abide by and adhere to the expressed requirements in ***all*** sections of this RFCSP.

SUBMITTED BY			
Primary Contact/Title:			
Company name:			
Phone:	Fax:	E-mail:	
Registered company address:			
City:	State:	ZIP Code:	
Website:	HUB:		
M/WBE:	EIN or SS#:	DUN:	

REMIT INFORMATION			
Contact Person:			
Address:			
City:	State:	ZIP Code:	
Phone:	Fax:	E-mail:	
Division/Bid#:			

ADDITIONAL REMIT ADDRESSES			
Location Name/Type:			
Address:			
City:	State:	ZIP Code:	
Phone:	Fax:	E-mail:	
Division/Bid#:			

PROPOSER QUALIFICATIONS	
How many years has your company been in this type of business?	
Number of staff in your organization?	
Are you willing to accept a split or multiple award?	
Are you willing to accept procurement card payment?	
Are criminal and civil arrest/charge records checked?	
Is random drug testing performed?	
Are your employees required to wear uniforms, name tags/badges and company identifications?	

HOW WOULD YOU LIKE TO RECEIVE YOUR PURCHASE ORDERS? EMAIL, FAX OR US MAIL *CHECK ALL THAT APPLY*		
☐ Fax	☐ E-mail	☐ U S Mail
PLEASE LIST ANY CURRENT AWARDED BIDS YOU HAVE WITH OTHER DISTRICTS OR CO-OPS		
Bid or Co-op#:	Contact:	Phone:
Bid or Co-op #:	Contact:	Phone:
Bid or Co-op #:	Contact:	Phone:

SIGNATURES OF COMPANY OFFICIAL	
Print Name:_____	Signature: _____
Print Title:	Date:

FORM B
DEVIATION/COMPLIANCE SIGNATURE FORM

If the undersigned Proposer intends to deviate from the Item(s) Specifications listed in this RFCSP document, all such deviations must be listed on this page, with complete and detailed conditions and information included or attached. **The District will consider any deviations in its RFCSP award decisions, and the District reserves the right to accept or reject any RFCSP based upon any deviations indicated below or in any attachments or inclusions.**

In the absence of any deviation entry on this form, the Proposer assures the District of his/her full compliance with the Terms and Conditions, Item Specifications, and all other information contained in this RFCSP document.

☐ **No Deviation** ☐ **Yes Deviations**

_____ _____

Signature Date

If yes is checked, please list below. Attach additional sheet(s) if needed.

_____

_____

_____

_____

_____

_____

FORM C
NON-COLLUSION STATEMENT

"The undersigned affirms that he/she is duly authorized to execute this RFCSP, that this company, corporation, Proposer, partnership or individual has not prepared this RFCSP in collusion with any other Proposer, and that the contents of this RFCSP as to prices, terms or conditions of said RFCSP have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this RFCSP."

Proposer hereby assigns to purchaser any and all claims for overcharges associated with this RFCSP which arise under the antitrust laws of the United States, 15 USCA Section 1 and which arise under the antitrust laws of the State of Texas, Business and Commerce Code, Section 15.01.

Does vendor agree? Yes_____ Initials of authorized company representative

FORM D
CRIMINAL BACKGROUND CHECK AND FELONY CONVICTION NOTIFICATION

(a) CRIMINAL BACKGROUND CHECK

Proposer will obtain history record information that relates to an employee, applicant for employment, or agent of the Proposer if the employee, applicant, or agent has or will have continuing duties related to the contracted services; and the duties are or will be performed on school property or at another location where students are regularly present. The Proposer certifies to the Birdville ISD before beginning work and at no less than an annual basis thereafter that criminal history record information has been obtained. Proposer shall assume all expenses associated with the background checks, and shall immediately remove any employee or agent who was convicted of a felony, or misdemeanor involving moral turpitude, as defined by Texas law, from Birdville ISD's property or other location where students are regularly present. Birdville ISD shall be the final decider of what constitutes a "location where students are regularly present." Proposer's violation of this section shall constitute a substantial failure.

If the Proposer is the person or owner or operator of the business entity, that individual may not self-certify regarding the criminal history record information and its review, and must submit original evidence acceptable to the District with this Agreement showing compliance.

(b) FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a), states, "A person or business entity that enters into a contract with a school district must give advance notice to the District if the person or owner or operator of the business entity has been convicted of a felony." The notice must include a general description of the conduct resulting in the conviction of a felony.
Subsection (b) states, "A school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction." The district must compensate the person or business entity for services performed before the termination of the contract.

I, the undersigned agent for the Proposer named below, certify that the information concerning criminal background check and notification of felony convictions has been reviewed by me, the following information furnished is true to the best of my knowledge, and I acknowledge compliance with this section. Proposer is responsible for the performance of the persons, employees and/or sub-Proposers. Proposer agrees to provide services for the Birdville ISD pursuant to this RFCSP on any and all Birdville ISD campuses or facilities. Proposer will not assign individuals to provide services at a Birdville ISD campus or facility who have a history of violent, unacceptable, or grossly negligent behavior or who have a felony conviction, without the prior written consent of the Birdville ISD Purchasing Department.

THE FELONY CONVICTION NOTICE IS NOT REQUIRED OF A PUBLICLY-HELD CORPORATION.

Proposer's Name:			
A. ***My firm is a publicly-held corporation; therefore, this reporting requirement is not applicable.***			**Y N**
B. ***My firm is not owned or operated by anyone who has been convicted of a felony.***			**Y N**
C. ***My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:***			
Name of Felon(s):			
Details of Conviction(s):			
Signature of Company Official:		Date:	
NOTE: Name and signature of company official should be the same as initials on the affidavit.			

FORM E
RESIDENT/NONRESIDENT CERTIFICATION

Texas Government Code Chapter 2252 relates to bids by nonresident Proposers. The pertinent portions of the Act are as follows:

Section 2252.001(3) "Nonresident bidder" means a bidder who is not a resident (of the State of Texas).

Section 2252.001(4) "Resident bidder" means a bidder whose principal place of business is in this state, including a Proposer whose ultimate parent company or majority owner has its principal place of business in this state.

Section 2252.002

A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located.

Company Name: _ is/isn't a Resident Bidder of Texas as defined in Texas Government Code Section 2252.001(4).

☐ **Yes - Resident** ☐ **No - Nonresident**

If the Bidder is a Nonresident Bidder of Texas, please answer the following:

Does the Proposer's ultimate parent company or majority owner employ at least 500 persons in Texas?	Yes _____ No _____

Does Proposer agree? Yes _____ Initials of authorized company representative

FORM F
REFERENCES

Proposers must provide at least three (3) references for which they have performed similar services within the past twenty-four (24) months. Two (2) of the references shall be school districts serviced. The references should be of like size and nature as the BISD. The references shall include the name of the company, contact person, phone number, fax number and e-mail address, length of time work has been performed, types of tasks performed and service provided. See attached reference sheet.

1.	Company Name:			
	Address:			
	City/State/Zip:			
	Contact Person:		Email:	
	Business Phone:		Fax:	
	Description of project or work completed:			
2.				
	Company Name:			
	Address:			
	City/State/Zip:			
	Contact Person:		Email:	
	Business Phone:		Fax:	
	Description of project or work completed:			
3.				
	Company Name:			
	Address:			
	City/State/Zip			
	Contact Person:		Email:	
	Business Phone:		Fax:	
	Description of project or work completed:			

FORM G
MODEL SB 9 PROPOSER CERTIFICATION FORM

Criminal History Record Information Review of Certain Contract Employees

Introduction: Texas Education Code Chapter 22 requires service Proposers to obtain criminal history record information regarding covered employees and to certify to the District that they have done so. Covered employees with disqualifying convictions are prohibited from serving at a school district.

Definitions:
Covered employees: Includes all employees of a Proposer (to include any subcontractors and/or independent Proposers) who have or will have continuing duties related to the service to be performed at the District and have or will have direct contact with students. The District will be the final arbiter of what constitutes direct contact with students.

Disqualifying conviction: One of the following offenses, if at the time of the offense: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or c) an equivalent offense under Federal law or the laws of another state.

On behalf of _____ ("Name of Proposer"),

I First Name: _____ Last Name: _____

Certify that [check one]:

[ ] None of the Proposer's employees are *covered employees,* as defined above.

Or

[ ] Some or all of the Proposer's employee are *covered employees.* If this box is selected, I further certify that:

Proposer has obtained all required criminal history record information, through the Texas Department of Public Safety, regarding its covered employees. None of the covered employees has a disqualifying conviction. Proposer has taken reasonable steps to ensure that its employees who are not covered employees do not have continuing duties related to the contract services or direct contact with students.

If Proposer receives information that a covered employee has a disqualifying conviction, Proposer will immediately remove the covered employee from contract duties and notify the District in writing within three (3) business days.

Upon request, Proposer will make available for the District's inspection the criminal history record information of any covered employee. If the District objects to the assignment of a covered employee on the basis of the covered employee's criminal history record information, Proposer agrees to discontinue using that covered employee to provide services at the District.

Noncompliance by the Proposer with this certification may be grounds for contract termination.

_____ _____
Signature Date

FORM H

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____
Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____
Signature of vendor doing business with the governmental entity Date

Form provided by Texas Ethics Commission www.ethics.state.tx.us Revised 11/30/2015

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

Form provided by Texas Ethics Commission www.ethics.state.tx.us Revised 11/30/2015

FORM I

HISTORICALLY UNDERUTILIZED BUSINESS (HUB) CERTIFICATION

Companies that have been certified by the Texas Building and Procurement Commission (TBPC) as Historically Underutilized Business (HUB) entities are encouraged to indicate their HUB status when responding to this Bid Invitation. The electronic catalogs will indicate HUB certification for vendors that properly indicate and document their HUB certification on this form.

☐ I certify that my company has been certified by the Texas Building and Procurement Commission as a Historically Underutilized Business (HUB), and I have attached a copy of our HUB Certification to this form. (Required documentation for recognition as a HUB).

- ☐ Minority
- ☐ Small Business
- ☐ Woman Owned

☐ My company has NOT been certified by the Texas Building and Procurement Commission as a Historically Underutilized Business (HUB).

_____

SIGNATURE OF AUTHORIZED REPRESENTATIVE

_____

NAME (PLEASE PRINT)

_____

TITLE

_____

DATE

FORM J

CERTIFICATION FOR CRIMINAL HISTORY CHECK
(In compliance with Texas Education Code § 22.0834(A))

"Covered employee" - A "covered employee" is a person who is an employee, applicant, agent or Subcontractor of the Contractor or of any Subcontractor of the Contractor, if (a) the person has or will have work duties related to the Project that will be performed on District property or at another location on a regular or repeated basis, (b) students are regularly present at such location, and (c) the person will have verbal or physical interaction with, or be in direct proximity to, one or more students.

"Direct contact with students"-The contact that results from activities that provide substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional district employee. Contact with students that results from services that do not provide substantial [the] opportunity for unsupervised interaction with a [an individual] student or students, such as addressing an assembly, officiating a sports contest, or judging an extracurricular event, is not, by itself, direct contact with students. However, direct contact with students does result from any activity that provides substantial [the] opportunity for unsupervised contact with students, which might include [such as], without limitation, the provision of [individualized] coaching, tutoring, or other services to students.

"Disqualifying conviction" - A "disqualifying conviction" is a conviction of (a) any felony under the Texas Penal Code, (b) any offense for which the person is required to register as a sex offender under Chapter 62 of the Texas Code of Criminal Procedure, (c) any equivalent offense under the laws of the United States or any other state, (d) any offense against a child, (e) misdemeanor possession of a controlled substance within 10 years, (f) any weapon offense, (g) theft, larceny, fraud, issuance of a bad check, theft by check above the class C misdemeanor level, or more than one offense at the class C level, (h) forgery, (i) altering an Official Document, (j) perjury, or (k) securing executing of a document by deception.

On behalf of _____ ("Contractor"), I certify that [check one]:

☐ None of Contractor's employees are covered employees, as defined above. The service contractor shall also certify that it will take reasonable steps to ensure that the conditions or precautions that have resulted in a determination that any person is not a covered contract employee continue to exist throughout the time that the contracted services are provided.

Or

☐ Some or all of Contractor's employee are covered employees. If this box is selected, I further certify that:

(1) Contractor has obtained all required criminal history record information, through the Texas Department of Public Safety, regarding its covered employees. None of the covered employees has a disqualifying conviction.

(2) If Contractor receives information that a covered employee has a disqualifying conviction, Contractor will immediately remove the covered employee from contract duties and notify the District in writing within 3 business days that it has done so. Noncompliance by Contractor with this certification may be grounds for contract termination.

_____

Signature Title Date

SECTION V
BIRDVILLE INDEPENDENT SCHOOL DISTRICT
STANDARD TERMS AND CONDITIONS

The words "bids," "request for proposals," "quotes," "RFPs," "RFCSPs," "solicitation," "procurement," and their derivatives may be used interchangeably in these terms and conditions. These terms and conditions apply to all procurement types to which they are attached. The term vendor, contractor or firm means each vendor chosen for award by Birdville ISD.

These Standard Terms and Conditions are part of the final contract and part of the terms and conditions of each purchase order issued in connection with this solicitation.

1. **INDEPENDENT PROPOSER** - Proposer shall operate hereunder as an independent Proposer and not as an officer, agent, servant or employee of Birdville ISD. Proposer shall have exclusive control of, and the exclusive right to control, the details of its operations hereunder and all persons performing same, and shall be solely responsible for the acts and omissions of its officers, agents, employees, Proposers, subcontractors and consultants.

2. **ASSIGNMENT** - The Proposer shall not sell, assign, transfer or convey any interest in this contract in whole or in part without the prior written consent of the Birdville ISD. No assignment, transfer or conveyance under this contract will be effective without the prior written consent of the School District.

3. **CONFLICT OF INTEREST** – The Proposer covenants and agrees that Proposer and its officers, employees, and agents will have no interest, including personal financial interest, and will acquire no interest, either directly or indirectly, which will conflict in any manner with the performance of the services called for under this Contract. No officer or employee of the School District shall have a financial interest, direct or indirect, in any contract with the BISD, or be financially interested, directly or indirectly, in the sale to the School District of any land, materials, supplies or services, except on behalf of the BISD or in compliance with the provisions of the Birdville ISD Policies and Procedures Manual. Any violation of this provision shall render this contract voidable at the discretion of the School District.

4. **SEVERABILITY** - In case any one or more of the provisions contained in this contract shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this contract, and this contract shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

5. **MODIFICATIONS** - This contract can be modified only by written agreement of the parties.

6. **GRATUITIES -** The District may, by written notice to the Proposer, cancel this RFCSP without liability to Proposer if it is determined by the District that gratuities, in the form of entertainment, compensation, gifts, or otherwise, were offered or given by the Proposer, or any agent or representative of the Proposer, to any Board Member, officer, or employee of the Birdville ISD with a view toward securing a RFCSP or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such an agreement.

7. **JURISDICTION -** The Purchase Order(s) resulting from this RFCSP shall be enforceable in Tarrant County, Texas, and if legal action is necessary by either party with respect to the enforcement of any and all of its terms and conditions, exclusive venue for same shall lie in Tarrant County, Texas.

8. **COMPLANCE WITH LAWS –** Vendor shall comply with all federal, state and local laws, statues, ordinances, rules and regulations, including, if applicable, worker's compensation laws, minimum and maximum salary and wage statues and regulations, prompt payment and licensing laws and regulations. For the entire duration of this contract, Vendor shall maintain all required licenses, certifications, permits and any other documentation necessary to perform this Agreement. When required or requested by Birdville ISD, Vendor shall furnish proof of Vendor's compliance with this provision.

9. **EQUAL OPPORTUNITY –** It is the policy of Birdville ISD not to discriminate on the basis of race, color, national origin, gender, limited English proficiency or handicapping conditions in its programs. Vendor agrees not to discriminate against any employee or applicant for employment to be employed in performance of this Agreement, with respect to hire, tenure, terms, conditions and privileges of employment, or matter directly or indirectly related to employment, because of age (except where based on bona fide occupational qualification) or race, color, religion, national origin, or ancestry. Vendor further agrees that every subcontractor entered into for the performance of this Agreement shall contain a provision requiring non-discrimination in employment herein specified, binding upon each subcontractor. Breach of this covenant may be regarded as a material breach of the agreement.

10. **MINORITY & WOMEN'S BUSINESS ENTERPRISE (MWBE), HISTORICALLY UNDERUTILIZED BUSINES (HUB) AND SMALL BUSINESS ENTERPRISE (SBE) PARTICIPATION –** Birdville ISD encourages the use of MWBE, HUB and SBE as prime and subcontractors. However, these entities must meet the same minimum standards and requirements of the prime contractor. It will be the responsibility of the prime contractor to pre-qualify any subcontractors offered as MWBE, HUB or SBE participants. Proposers shall indicate on their submitted proposals whether or not they are WMBE, HUB or SBE vendor and whom they are certified e.g. City, State, Federal. Complete the enclosed HUB Certification and provide a copy of the certificate(s) with the proposal. Please note that Birdville ISD does not have any percentage of participation or a disparity study completed.

11. **SAFETY –** Vendors, its subcontractors, and their respective employees shall comply fully with all applicable federal, state, and local safety and health laws, ordinances, rules and regulations in the performance of services under this Agreement, including without limitation, those promulgated by Birdville ISD and by the Occupational Safety and Health Administration (OSHA). All items must meet all applicable OSHA standards and regulations and all electrical items must bear appropriate listing from UL, FMRC or NEMA. In case of conflict, the most stringent safety requirements shall govern. Vendor shall comply with all other safety guidelines and standards as required by Birdville ISD. Vendor shall indemnify and hold Birdville ISD, harmless from all claims, demands, suits, actions, judgments, fines, penalties and liability of every kind arising from the breach of Vendor's obligations under this provision.

12. **MATERIAL SAFETY DATA SHEET –** Vendor must provide, at no cost, at least one copy of any applicable Manufacturer's Material Safety Data Sheet(s) (MSDS) with each shipment during the term of the contract. If OSHA or Federal or State laws provide for additional requirements, those requirements are in addition to the MSDS required.

13. **RECYCLED MATERIALS –** Texas state law requires that a purchasing preference be given to any product made from recycled material if it meets written specifications as to quality and quantity. If a product bid on this solicitation contains recycled material, identify the item number and report the percent of the recycled material in the product and the percent of the post-consumer material used in the product. "Post-consumer" means material that has been recycled after sale to a consumer as opposed to reuse of manufacturing waste prior to sale. In addition, identify any products that meet the criteria of "Environmentally Sensitive."

14. **REMEDIES** - No right or remedy granted herein or reserved to the parties is exclusive of any right or remedy herein by law or equity provided or permitted; but each shall be cumulative of every right or remedy given hereunder. No covenant or condition of this contract may be waived without consent of the parties. Forbearance or indulgence by any party shall not constitute a waiver of any covenant or condition to be performed pursuant to this contract.

15. **NON-APPROPRIATION CLAUSE** – In accordance with Texas Local Government Code 271.903 concerning non-appropriation of funds for multi-year contracts, the proposer recognizes that the continuation of any contract after the close of any given fiscal year of the School District, which fiscal year ends on June 30 of each year, shall be subject to School Board budget approval. Should funding not be approved by the School Board for any given budget year during the contract term, the contract will terminate and become null and void.

16. **PROPOSER TO PACKAGE GOODS** - Proposer will package goods in accordance with good commercial practice. Each shipping container, shall be clearly and permanently marked as follows: (a) Proposer's name and address: (b) Consignee's name, address and purchase order or purchase change order number; (c) Container number and total number of containers, e.g., box 1 of 4 boxes; and (d) Number of the container bearing the packing slip. Proposer shall bear cost of packaging unless otherwise provided. Goods shall be suitably packed to secure lowest transportation costs and to conform to requirements of common carriers and any applicable specifications. District's count or weight shall be final and conclusive on shipments not accompanied by packing list.

17. **PLACE OF DELIVERY** - The place of delivery shall be set forth in the block of the purchase order or purchase change order entitled "Ship To."

18. **TITLE AND RISK OF LOSS** - The title and risk of loss of goods shall not pass to the Birdville ISD until the School District actually receives and takes possession of the goods at the point(s) of delivery, after inspection and acceptance of goods.

19. **FORCE MAJEURE** - Neither Proposer nor the District shall be responsible or deemed to be in default of its obligations to the other to the extent any failure to perform or delay in performing its obligations under this RFCSP is caused by events or conditions beyond the reasonable control of that party, and are not due to the negligence or willful misconduct of such party (hereinafter, "Force Majeure events"). For purposes of this RFCSP, Force Majeure events shall include, but not be limited to, acts of God or public enemy, war, riot or civil commotion, strikes, epidemic, fire, earthquake, tornado, hurricane, flood, explosion, or other catastrophes, or events or conditions due to governmental law, regulations, ordinances, order of a court of competent jurisdiction, executive decree or order. However, in the event of such delay(s) or nonperformance, the party so delayed shall furnish prompt written notice to the other party (including the date of inception of the Force Majeure event and the extent to which it will affect performance) and shall undertake all efforts reasonably possible to cure the delay or nonperformance and mitigate its effects or to otherwise perform. The District shall not be responsible for payment for any product or service delayed or foreclosed by any Force Majeure event unless and until such delayed or foreclosed product or service is provided. The provisions of this section shall not preclude the District from canceling or terminating any resulting award (or any order for any goods or services included herein), or from revising the scope of the Work, as otherwise permitted under this RFCSP.

20. **RIGHT OF INSPECTION** - BISD shall have the right to inspect the goods upon deliver before accepting them. Proposer shall be responsible for all charges for the return to Proposer of any goods rejected as being nonconforming under the specifications.

21. **RIGHT TO AUDIT** - Proposer agrees that the BISD shall, until the expiration of three (3) years after final payment under this Contract, have access to and the right to examine any directly pertinent books, documents, papers and records of the Proposer involving transactions relating to this Contract. Proposer agrees that the School District shall have access, during normal working hours, to all necessary Proposer facilities, and shall be provided adequate and appropriate workspace, in order to conduct audits in compliance with the provisions of this section. The BISD shall give Proposer reasonable advance notice of intended audits.

22. **PRODUCT GUARANTEE** - Proposer guarantees equipment or product offered will meet or exceed specifications identified in this proposal invitation. The proposer shall, upon request, replace any equipment or product proved to be defective and make any and all adjustments necessary without any expense to the District. If at any time, the equipment or product cannot satisfactorily meet the requirements of the specifications, the proposer shall, upon written request from the District, promptly remove such equipment or product without any further expense to the District.

23. **GEOGRAPHIC PREFERENCE** – Birdville ISD may apply preference to agricultural products produced, processed, or grown in Texas if the cost to the school district is equal and the quality is equal; if agriculture products produced, processed, or grown in Texas are not equal in cost and quality to other products, the school district give preference to agriculture products produced, processed, or grown in other states of the United States over foreign products if the cost to the school district is equal and the quality is equal; a school district that purchases vegetation for landscaping purposes, including plants, shall give preference to Texas vegetation if the cost to the school district is equal and the quality is not inferior. Preferences must be explicitly claimed by Vendor and may not be applicable in procurements and/or contracts involving federal funds unless the procurement and/or contract involves unprocessed locally grown or locally raised agricultural products for use by Birdville ISD, in a Child Nutrition Program. See Texas GOV'T Code 2252.001-.004; 2 C.F.R 200.319.

24. **COPYRIGHT** – All contracts paid from State or Federal grants administered by a State or Federal agency must retain copyright for the State and Federal government (if a Federally funded contract) unless otherwise negotiated in writing with the State or Federal agency pursuant to the provisions in 2 CFR 200.315, title to intangible property vents the Birdville ISD, as long as such property is used for authorized purposes. However, the State and Federal awarding agency reserve a royalty-free, non-exclusive and irrevocable right to reproduce, publish, or otherwise use the work for Federal purposes, and to authorize others to do so. The Vendor agrees to protect Birdville ISD, from any claim involving infringement of patents or copyrights.

25. **PRICE WARRANTY** - The price to be paid by the BISD shall be that contained in Proposer's proposal, which Proposer warrants to be no higher than Proposer's current prices on orders by others for products of the kind and specification covered by this contract for similar quantities under like conditions and methods of purchase. In the event Proposer breaches this warranty, the prices of the items shall be reduced to Proposer's current prices on orders by others, or in the alternative upon School District's option, BISD shall have the right to cancel this contract without liability to Proposer for breach or for Proposer's actual expense.

26. **SILENCE OF SPECIFICATION** - The apparent silence of these specifications as to any detail or to the apparent omission from it of a detailed description concerning any point shall be regarded as meaning that only the best commercial practices are to prevail. All interpretations of these specifications shall be made on the basis of this statement.

27. **INDEMNIFICATION** – **Proposer does hereby agree to waive all claims, release, indemnify and both hold harmless the School District, its officials, agents and employees, in both their public and private capacities, from and against any and all liability, claims, losses, damages, suits, demands or causes of action, including all expenses of litigation and/or settlement, court costs and attorney fees, which may arise by reason of death or injury to persons or loss of, damage to, or loss of use of any property occasioned by any error, omission, or negligent act of the Proposer, its officers, agents, employees, subcontractors, invitees, or other persons for whom the Proposer is legally liable, arising out of or in connection with the performance of this contract, and Proposer will at its own cost and expense defend and protect the School District against any and all such claims and demands.**

28. **NON-DISCRIMINATION** - Proposer shall not discriminate against any employee or applicant for employment of Proposer or of the School District because of race, age, color, religion, sex, national origin, ancestry, disability, or place of birth. Proposer shall take action to ensure that all persons are employed and/or treated without regard to their race, age, color, religion, sex, national origin, ancestry, disability, or place of birth. This action shall include, but not be limited to the following: employment, promotion, demotion, transfer, working conditions, recruitment, layoff, termination, rates of pay or other forms of compensation, and training opportunities.

29. **DISABILITY** - In accordance with the provisions of the Americans With Disabilities Act of 1990 (ADA), Proposer warrants that it, and any and all of its subcontractors, will not unlawfully discriminate on the basis of disability in the provision of services to the general public, nor in the availability, terms and/or conditions of employment for applicants for employment with, or employees of Proposer or any of its subcontractors. **Proposer warrants it will fully comply with ADA's provisions and any other applicable federal, state and local laws concerning disability and will defend, indemnify and hold the School District harmless against any claims or allegations asserted by third parties or subcontractors against School District arising out of Proposer's and/or its subcontractor's alleged failure to comply with the above-referenced laws concerning disability discrimination in the performance of this contract.**

30. **DRUG POLICY** - All BISD property and facilities are a "drug-free zone." No one may use, consume, carry, transport, or exchange tobacco, cigarettes or illegal drugs while in a School District building or while on School District property. The responding company and its employees shall adhere to this policy.

31. **TERMINATION FOR DEFAULT** - BISD reserves the right to terminate the contract without prior notice in the event the Proposer defaults or breaches any of the terms and conditions of this contract, or otherwise fails to perform in accordance with the proposal specifications. In the event of termination the School District reserves the right to complete the work or services in any manner it deems desirable, including engaging the services of other parties therefore and/or awarding the proposal to the next lowest responsible proposer. Any such act by the School District shall not be deemed a waiver of any other right or remedy. If after exercising any such remedy, the cost to the School District of the performance of the balance of the work or services is in excess of that part of the contract sum, which has not therefore been paid to the Proposer hereunder, Proposer shall be liable for and shall reimburse the School District for such excess. Proposers shall, for this purpose, keep their proposals open and prices fixed for a period of 90 days following the award of this proposal.

32. **TERMINATION WITHOUT CAUSE** - BISD shall have the right to terminate the contract, in whole or in part, without cause any time upon thirty (30) days' prior written notice. Upon receipt of a notice of termination, the Proposer shall promptly cease placing orders and all further work pursuant to the Contract, with such exceptions, if any, specified in the notice of termination. BISD shall pay the Proposer, to the extent funds are appropriated or otherwise legally available for such purposes, for all goods delivered and services performed and obligations incurred prior to the date of termination in accordance with the terms hereof.

33. **NO THIRD-PARTY BENEFICIARY** – For purposes of this contract, including its intended operation and effect, the parties to this contract specifically agree and contract that: (1) the agreement only affects matters/disputes between the parties to this contract, and is in no way intended by the parties to benefit or otherwise affect any third person or entity, notwithstanding the fact that such third person or entity may be in a contractual relationship with School District or Proposer or both; and (2) the terms of this contract are not intended to release, either by contract or operation of law, any third person or entity from obligations owing by them to either School District or Proposer.

34. **ENTIRE AGREEMENT** – This contract embodies the complete agreement of the parties hereto, superseding all oral or written previous and contemporary agreements between the parties relating to matters herein and, except as otherwise provided herein, cannot be modified without written agreement of the parties.

DOCUMENT 00 31 32

GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 LOG OF BORINGS/CONTRACTOR RESPONSIBILITY

A. A copy of the locations and log of borings is bound herein. Subsurface soil data derived from test borings are given only for the convenience of the Contractor, and neither the Owner nor the Architect assumes responsibility for the accuracy of or for the Contractor's interpretation of the data. Contractor is responsible for any conclusions drawn from the boring data and is responsible for the work without extra compensation irrespective of whether or not the subsurface conditions encountered agree with the boring data.

1.2 REPORT

A. The full geotechnical report prepared by the Owner's independent geotechnical and testing laboratory is available in the Architect's office for inspection by the Contractor.

B. This geotechnical report is not a part of the Contract Documents.

END OF DOCUMENT

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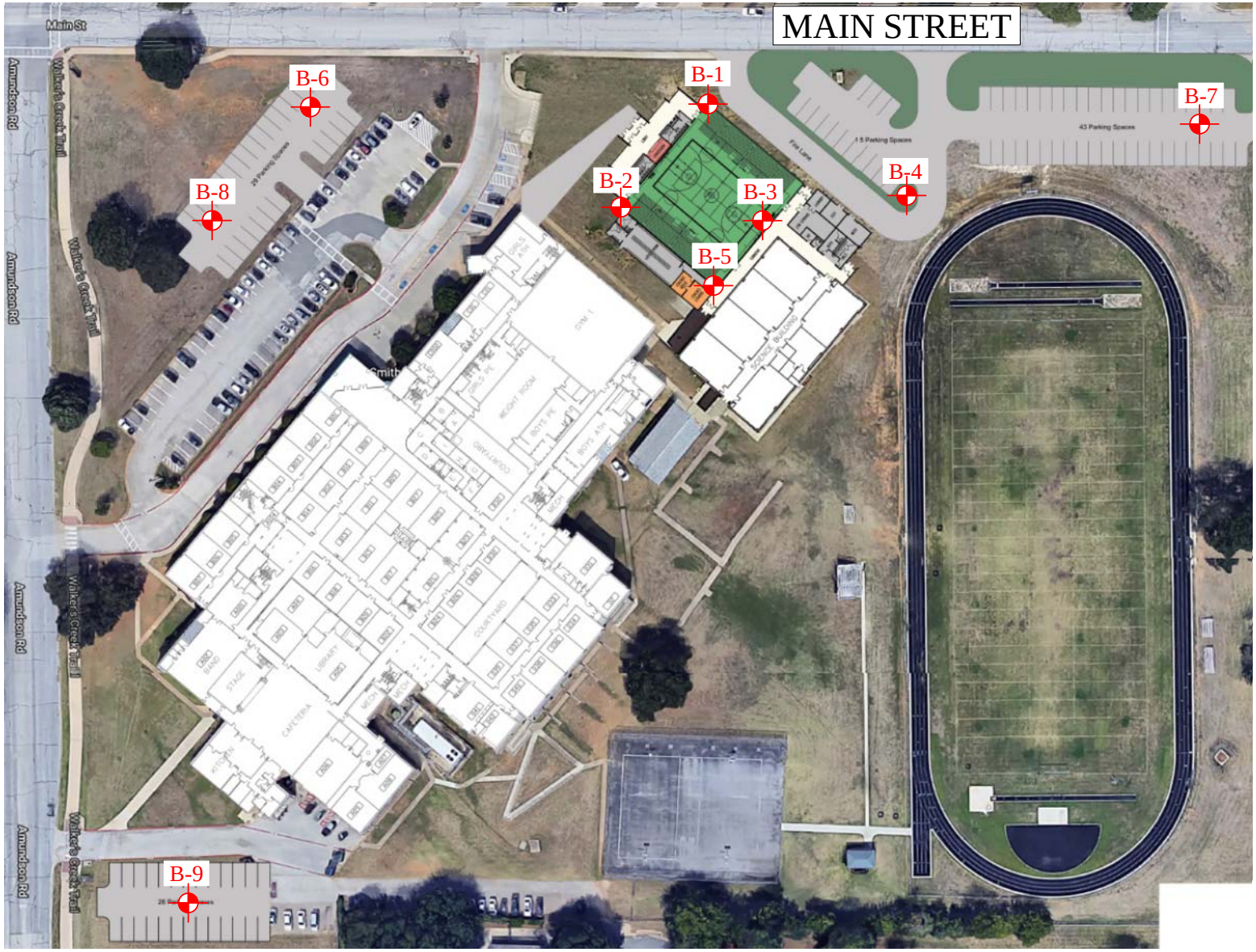

GEOTECHNICAL EXPLORATION
SMITHFIELD MIDDLE SCHOOL
GYMNASIUM ADDITION
8400 MAIN STREET
NORTH RICHLAND HILLS, TEXAS
ALPHA PROJECT NO. W190349-REV1

ALPHA TESTING
WHERE IT ALL BEGINS

FIGURE 1

BORING LOCATION PLAN

APPROXIMATE BORING LOCATION

ALPHA TESTING
WHERE IT ALL BEGINS

5058 Brush Creek Rd.
Fort Worth, Texas
76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 1
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/15/2019 **End Date:** 3/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): 9
▼ After Drilling (ft): 40
▽▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAY	2.0				3.0				24	71	23	48
		Tan, Gray, and Red CLAYEY SAND	4.0				4.5		58		17	40	20	20
5		Red, Tan, and Gray SAND	6.0				3.5				9			
		Tan and Gray CLAYEY SAND				50					12	24	12	12
	▽													
10						50/ 3"					13			
15						50/ 5"					18			
			18.0											
20		Gray CLAY SHALE with limestone seams				50/ 5"			92		19	68	23	45
25			25.0			100/ 1.25"								
		Gray SHALE												
30						100/ 2.5"								
35						100/ 3.5"								
40	▼					100/ 5"								
45						100/ 2"								
50						100/ 1"								
55						100/ 3"								
60						100/ 1.5"								
65			65.0			100/ 1"								
		TEST BORING TERMINATED AT 65 FT												

ALPHA TESTING
WHERE IT ALL BEGINS

5058 Brush Creek Rd.
Fort Worth, Texas
76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 2
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/14/2019 **End Date:** 3/14/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): 6
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAYEY SAND				2.0				22			
		2.0											
		Light Brown CLAYEY SAND				3.75		40		17	27	14	13
5		▽ 6.0				1.0				15			
		Tan and Reddish Gray CLAYEY SAND with some clay seams and layers				2.25				20	33	16	17
						3.25				19			
10													
15						3.75		75		14	34	17	17
20						3.5				13			
		22.0											
		Gray CLAY SHALE with limestone seams			50/ 3"								
25													
30		30.0			50/ 3"								
		Gray SHALE											
					100/ 0.75"								
35													
					100/ 2"								
40													
					100/ 5"								
45													
					100/ 5"								
50													
					100/ 2.5"								
55													
					100/ 2"								
60													
					100/ 1.25"								
65		65.0											
		TEST BORING TERMINATED AT 65 FT											

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BORING NO.: 3
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/11/2019 **End Date:** 3/11/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): 14
▼ After Drilling (ft): 33
▽▼ After ____ Hours (ft):

Depth, feet	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
	5" CONCRETE 0.4				2.5				23			
	Brown SANDY CLAY with gravel 2.0				3.25				23	60	21	39
5	Brown CLAY with calcareous nodules 4.0				4.5+				25	36	14	22
	Brown SANDY CLAY				4.5+				13			
10					3.25				13	19	10	9
15	▽ 15.0			10					16			
	Tannish Red SANDY CLAY											
20				60					18	26	13	13
	23.0											
25	Tan and Gray SANDY CLAY			29					18	43	20	23
	28.0											
30	Gray CLAY SHALE			48			99		19	51	19	32
	▼											
35				50/ 4.5"					17			
40	40.0			100/ 5"								
	Gray SHALE											
45				100/ 5"								
50				100/ 3.25"								
55				100/ 0.75"								
60				100/ 2.25"								
65	65.0			100/ 1.25"								
	TEST BORING TERMINATED AT 65 FT Gray CLAY SHALE											

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BORING NO.: 4
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/18/2019 **End Date:** 3/18/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): 7
▼ After Drilling (ft): 45
▽▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAYEY SAND				4.5+				11	27	13	14
		4.0								10			
5		Light Brown and Tan CLAYEY SAND				2.0		36		16	32	15	17
	▽					1.0				20			
10		10.0				1.0		31		20	23	12	11
		Tan, Gray, and Red CLAYEY SAND											
15					17					23			
		18.0											
20		Tan and Gray SHALY CLAY			34			78		20	55	19	36
25					27			92		22	55	19	36
		27.0											
		Tan LIMESTONE with clay seams and layers											
		29.0											
30		Gray LIMESTONE with shale seams			50/ 4.5"					17			
		32.0											
		Gray CLAY SHALE											
35					73/ 9.5"								
40					100/ 6.5"								
45	▼	45.0			100/ 5.25"								
		Gray SHALE											
50					100/ 1"								
55					100/ 4.5"								
60					100/ 1"								
65		65.0			100/ 4.5"								
		TEST BORING TERMINATED AT 65 FT											

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BORING NO.: 5
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/11/2019 **End Date:** 3/11/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): 10
▼ After Drilling (ft): 25
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		5" CONCRETE	0.4				2.0				26	57	19	38
		Brown CLAY with gravel - FILL	2.0								9	17	8	9
		Brown SAND	4.0				2.75				17	31	15	16
5		Tan and Red SANDY CLAY				9					13			
10	▽		10.0			8					18			
		Tan, Red, and Gray CLAYEY SAND												
15						26					15	32	16	16
			18.0											
20		Red SAND with poorly cemented hard seams				50/ 6"					14			
			23.0											
25	▼	Tan and Red SANDY CLAY with gravel	25.0			50/ 4"			70		19	41	20	21
		Tan LIMESTONE	28.0											
30		Gray CLAY SHALE with some hard sandstone seam layers				50/ 6"					14			
35						50/ 5"			92		24			
40						50/ 5"					19			
45						58					19			
50			50.0			100/ 2.75"								
		Gray SHALE with limestone seams												
55						100/ 3"								
60						100/ 2"								
65			65.0			100/ 2"								
		TEST BORING TERMINATED AT 65 FT												

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BORING NO.: 6
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/15/2019 **End Date:** 3/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAYEY SAND				1.0		13		36	28	14	14
		2.0											
		Red, Gray, and Tan CLAYEY SAND				2.5	0.7		75	67			
5		5.0				2.5		35		23	45	22	23
		TEST BORING TERMINATED AT 5 FT											
10													
15													
20													
25													
30													
35													
40													
45													
50													
55													
60													
65													

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BORING NO.: 7
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/15/2019 **End Date:** 3/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAY with concrete fragments and calcareous nodules - FILL 2.0				4.5+	1.9		113	17			
5		Light Brown CLAYEY SAND 5.0				4.0 1.75		47		14 19	33 31	16 15	17 16
		TEST BORING TERMINATED AT 5 FT											

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BORING NO.: 8
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/15/2019 **End Date:** 3/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAYEY SAND 2.0				1.0		21		20	36	17	19
5		Reddish Tan CLAYEY SAND 5.0				2.0		17		18 18	33	16	17
		TEST BORING TERMINATED AT 5 FT											

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BORING NO.: 9
Sheet 1 of 1
PROJECT NO.: W190349

Client: Birdville ISD
Project: Smithfield Middle School - Gymnasium Addition
Start Date: 3/15/2019 **End Date:** 3/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: North Richland Hills, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
5		Brownish Red CLAYEY SAND 5.0						20		12 12 13	19	10	9
		TEST BORING TERMINATED AT 5 FT											

DRAFT

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Birdville Independent School District »« »
«6125 East Belknap Street »
«Haltom City, Texas 76117 »

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

« »
« »
« »

The Architect:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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User Notes: (1263290179)

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

§ 1.1 The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), all sections of the Project Manual and Construction Documents, Drawings, Specifications, Geotechnical Reports, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9. Any reference to Contract Documents or any documents included in the Contract Documents and/or supplemented for this Project, shall refer to the Contract Documents as amended for this Project. *(Warning: Make sure that any Supplementary Conditions do not contradict the provisions of the A201.)*

"Construction Documents" means: all Drawings, specifications, submittals, transmittals, deliverables, instructions to Contractors, and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants and which set forth in detail the requirements for construction of the Project.

§ 1.2 This Agreement represents the entire and integrated agreement between the Owner and the Contractor and supersedes all prior negotiations, representations or agreements, either written or oral. Any revision, amendment, or modification to the Standard Form of this Agreement shall be valid, binding, and enforceable only if said revision, amendment or modification is made conspicuous by being underlined, lined-through, or highlighted in this Agreement signed by Contractor and the authorized representative of Owner's Board of Trustees. In the event of conflict, terms and conditions contained in the Agreement shall take precedence over terms and conditions contained in the General Conditions and the terms and conditions in the General Conditions shall take precedence over all other terms and conditions contained in the other Contract Documents. If the Request for Proposals and the Proposal are included in the Contract Documents, then the Request for Proposals shall take precedence over the Proposal, unless specifically agreed otherwise herein.

§ 1.3 The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to enter into or amend a contract, to approve changes in the scope of the Work, to approve and execute a Change Order or Construction Change Directive modifying the Contract Sum, or to agree to an extension to the date of Substantial or Final Completion or to terminate a contract. The Owner designates the following as the individual authorized to sign documents on behalf of the Board of Trustees, following appropriate Board action: C. Richard Davis, Jr., President, Board of Trustees, or other Board designee.

§ 1.4 The Board designates the authorized representatives identified in Paragraph 8.3 to act on its behalf in other respects.

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ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« X »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« The commencement date will be the first business day after the Contractor's receipt of the written notice to proceed. The notice to proceed shall not be issued by Architect until the Agreement has been signed by the Contractor, approved by the Owner's Board of Trustees, signed by the Owner's authorized representative, and Owner and Architect have received all required payment and performance bonds and insurance, in compliance with Article 11 of AIA Document A201-2017. »

~~If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.~~

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall diligently prosecute and achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

Final Completion shall be 30 calendar days after the date of Substantial Completion, subject to adjustments of the Contract Time as provided in the Contract Documents.

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.
(Note: Optional Paragraph)

§ 4.1.1 The Contract Sum contains an Owner's Contingency in the amount of $_____. This contingency is for the sole use of the Owner to be used for changes in the scope of the Work and for the betterment of the Project.

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Owner's authorized representative may approve any expenditure from Owner's Contingency without further Board of Trustees approval. If the Owner's Contingency is not expended or not fully expended, then any unused portion shall belong to the Owner and shall be credited to the Owner in calculating final payment.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 [Paragraph Deleted]. ~~Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.~~

~~(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)~~

~~Item~~	~~Price~~	~~Conditions for Acceptance~~

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

« **§ 4.5.1 Substantial Completion.** Time is of the essence in all phases of the Work. It is specifically understood and agreed by and between Owner and Contractor that time is of the essence in the Substantial Completion of the Project and Owner shall sustain damages as a result of Contractor's failure, neglect or refusal to achieve said deadlines. Such damages are, and will continue to be, impracticable and extremely difficult to determine. Execution of this Agreement under these specifications shall constitute agreement by Owner and Contractor that the amounts stated below are the minimum value of the costs and damages caused by failure of Contractor to complete the Work within the allotted or agreed extended times of Substantial Completion, that such sums are liquidated damages and shall not be construed as a penalty, and that such sums may be deducted from payments due Contractor if such delay occurs. It is expressly understood that the said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not completed within the agreed time, or within the agreed extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty, said damages being caused by, but not limited to, additional compensation for personnel, attorneys fees, architectural fees, engineering fees, program management fees, inspection fees, storage costs, food service costs, transportation costs, utilities costs, costs of temporary facilities, loss of interest on money, and other increased costs, all of which are difficult to exactly ascertain. Failure to complete the Work within the designated or agreed extended dates of Substantial Completion, shall be construed as a breach of this Agreement. It is expressly agreed as a part of the consideration inducing the Owner to execute this Agreement that the Owner may deduct from any Payment made to the Contractor a sum equal to $1,000 per day for each and every additional calendar day beyond the agreed date of Substantial Completion.

§ 4.5.2. Final Completion. In addition, timely Final Completion is an essential condition of this Agreement. Contractor agrees to achieve Final Completion of the Agreement within 30 calendar days of the designated or agreed extended date of Substantial Completion. It is specifically understood and agreed by and between Owner and Contractor that time is of the essence in the Final Completion of the Project and Owner shall sustain additional

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damages as a result of Contractor's failure, neglect or refusal to achieve said deadline. Such damages are, and will continue to be, impracticable and extremely difficult to determine. Execution of this Agreement under these specifications shall constitute agreement by Owner and Contractor that the amounts stated below are the minimum value of the costs and damages caused by failure of Contractor to complete the Work within the allotted or agreed extended times for Final Completion, that such sums are liquidated damages and shall not be construed as a penalty. It is expressly understood that the said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not finally completed within the agreed time, or within the agreed extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty, said damages being caused by, but not limited to, additional compensation for the following categories of damages to the Owner: potential hazards to students, staff and visitors, additional architectural, engineering, program management fees (and fees of any other consultants); increased administrative or operational expenses; additional attorney's fees; increased maintenance and custodial costs and additional, utilities, security and clean-up costs, and other increased costs. Failure to complete the Work within the designated or agreed extended dates of Final Completion, shall be construed as a breach of this Agreement. Owner and Contractor agree that should Contractor fail to achieve Final Completion of the Agreement by the deadline, Owner shall continue to be damaged to a greater degree by such delay. Contractor and Owner agree that the amount of liquidated damages for each calendar day Final Completion is delayed beyond the date set for Final Completion shall be the sum of $1,000 per day. Owner may deduct such liquidated damages from any Payment made to Contractor before or at Final Payment; or, if sufficient funds are not available, then Contractor shall pay Owner, the amounts specified per day for each and every calendar day the breach continues after the deadline for Final Completion of the Work.

§ 4.5.3 Such damages shall be in addition to, and not in lieu of, any other rights or remedies Owner may have against Contractor for failure to timely achieve Final Completion, and damages for failure to achieve Substantial Completion and failure to achieve Final Completion may run concurrently. If the Work is not finally completed by the time stated in the Agreement, or as extended, no payments for Work completed beyond that time shall be made until the Project reaches Final Completion. »

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 ~~Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.~~ The Contractor shall submit monthly Applications for Payment to the Architect on AIA Form G702 for approval. Continuation sheets shall be submitted on AIA Form G703. If the Architect approves the application, then they shall submit a Certificate for Payment to the Owner. The Architect may require any additional information deemed necessary and appropriate to substantiate the Application for Payment. Materials that are verified to be on the jobsite or other approved location for use in the Project may also be incorporated into the Application for Payment. The Architect shall have seven (7) days from date of receipt from the Contractor of an Application for Payment to approve or reject all or any part of the Application for Payment. The Owner shall pay the undisputed amounts certified by the Architect to the Contractor within forty-five (45) days of receipt of the Certificate for Payment from the Architect unless otherwise provided in the Contract Documents. Undisputed

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amounts unpaid after the date on which payment is due shall bear interest pursuant to Texas Government Code Section 2251.025.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum, less any unused Owner's contingency, among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified to the extent approved by the Owner in writing, as provided in Article 7.3.9 of AIA Document A201™–2017, General Conditions of the Contract for Construction.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017 or amounts certified by the Architect and disputed by the Owner; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner ~~may~~ shall withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

«Five percent (5%) [*If the retainage is over 5%, then the retainage shall be deposited in an interest-bearing account and the interest earned on the retainage shall be paid to the Contractor upon completion of the Project, pursuant to Texas Government Code Section 2252.032*]~~-~~»

§ 5.1.7.1.1 [Paragraph Deleted.] ~~The following items are not subject to retainage:~~
~~(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)~~

~~«~~ »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

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(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

«NONE. »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon ~~Substantial~~ Final Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. ~~The Application for Payment submitted at Substantial Completion shall not include retainage as follows:~~
~~*(Insert any other conditions for release of retainage upon Substantial Completion.)*~~

~~« »~~

§ 5.1.8 [Paragraph Deleted.] ~~If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.~~

§ 5.1.9 Except with the Owner's prior written approval, or as otherwise provided in Section 9.3.2 of the AIA Document A201-2017, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.10 If Owner is entitled to deduct liquidated damages, or any other damages or amounts provided in the Contract Documents, including clean-up fees, then Owner shall be entitled to deduct such liquidated damages, amounts and fees at any time.

§ 5.1.11 If Contractor fails or refuses to complete the Work, or has unsettled claims with Owner, any payment to Contractor shall be subject to deduction for such amounts as the Architect if applicable, shall determine as the cost for completing incomplete Work and the value of unsettled claims.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, minus disputed sums, authorized deductions and liquidated damages, shall be made by the Owner to the Contractor ~~when~~after

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct nonconforming Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; ~~and~~

.2 the Contractor has provided all documents required by Sections 3.5 ***et seq***. and 9.10.2 *et seq*. of AIA Document A201-2017

.3 a final Certificate for Payment has been issued by the Architect; and

4. Owner's Board of Trustees has voted to accept the Work and approve the Final Payment.

§ 5.2.2 The Owner's final payment of undisputed sums to the Contractor shall be made no later than 30 days after Owner's Board of Trustees' vote approving Final Payment. ~~the issuance of the Architect's final Certificate for Payment, or as follows:~~

~~« »~~

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest pursuant to Texas Government Code Section 2251.025. ~~from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~
~~*(Insert rate of interest agreed upon, if any.)*~~

~~« »~~ % ~~« »~~

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

All disputes relating to this Agreement shall be resolved pursuant to the terms of Article 15 of the AIA Document A201-2007, as amended. ~~The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA~~

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~~Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.~~
~~*(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*~~

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[«X »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 [Paragraph Deleted] ~~If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:~~
~~(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)~~

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

«Conan Mathson
Senior Officer – Design and Construction, or his successor
Birdville Independent School District »
«6125 East Belknap Street »
«Haltom City, Texas 76117 »
«conan.mathson@birdvilleschools.net
Office: (817) 547-5851 »

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

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§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior written notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

«**§ 8.7.1** The Agreement shall be governed by the laws of the State of Texas, and any litigation shall be conducted in state district court. Mandatory and exclusive venue shall be in Tarrant County, Texas, or, if no county is specified, then in the county in which the Owner's main administrative office is located.

§ 8.7.2 As a material consideration of the making of this Agreement, the modifications to this Agreement shall not be construed against the maker of said modifications.

§ 8.7.3 Notwithstanding anything to the contrary in this Agreement, or in any document forming a part hereof, there shall be no mandatory arbitration for any dispute arising hereunder.

§ 8.7.4 Section 1.5 of AIA Document A201-2017 shall govern Contractor's use of the Construction Documents.

§ 8.7.5 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors. As part of that responsibility, Contractor shall enforce the Owner's alcohol-free, drug-free, tobacco-free, harassment-free and weapon-free policies and zones, which will require compliance with those policies and zones by Contractor's employees, subcontractors, and all other persons carrying out the Contract.

§ 8.7.6 Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, to wear identification tags on the front of their persons during all times that they are on Owner's property. Such identification tags shall contain a current photograph and the worker's full name in a typeface large enough to be seen from a reasonable distance.

§ 8.7.7 Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, to park their personal motor vehicles on Owner's property only in the parking places designated by the Owner's campus principal. Any vehicles not parked in the appropriate locations shall be towed at the vehicle owner's sole expense.

§ 8.7.8 Contractor shall follow, and shall require all employees, agents or subcontractors to follow, applicable ordinances of the municipality in which the Project is located. In addition, if not covered by the municipality's tree ordinance, Contractor shall barricade and protect all trees on the Project.

§ 8.7.9 Contractor shall institute a theft deterrence program designed to restrict construction worker access to properties of Owner that are currently in use, to maintain supervision of Contractor's and Contractor's

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subcontractor's forces, and to reimburse the Owner or those persons suffering a theft loss which results from Contractor's forces or Contractor's subcontractor's forces' actions, omissions, or failure to secure the Work or connecting or adjacent property of Owner.

§ 8.7.10 The Contractor may not assign its responsibilities, duties, obligations and rights under this Agreement, without the express written consent of the Owner. This does not prevent Contractor from engaging subcontractors to perform various phases of the Project, but Contractor shall be fully responsible to Owner for the work, actions and omissions of all such subcontractors

§ 8.7.11 This Agreement, in its entirety, shall be binding upon all the parties hereto, their respective successors, heirs, executors, administrators or assigns.

§ 8.7.12 Execution of this Agreement shall constitute approval and acceptance of all terms, covenants and conditions as modified and contained in the Contract Documents.

§ 8.7.13 This Agreement is subject to all applicable federal and state laws, rules, and regulations. Invalidity of any portion of this Agreement under the laws of the State of Texas or of the United States shall not affect the validity of the remainder of this Agreement.

§ 8.7.14 By signing this Agreement, the undersigned certifies as follows: "Under Section 231.006, Texas Family Code, the vendor or applicant certifies that the individual or business entity named in the contract, bid, or application is not ineligible to receive the specified grant, loan, or payment and acknowledges that this contract may be terminated, and payment may be withheld if this certification is inaccurate."

§ 8.7.15 Unless otherwise noted, terms in this Agreement shall have the same meaning as those in the edition of AIA Document A201-2007, General Conditions of the Contract for Construction, as amended for the Project.

§ 8.7.16 To the extent that any portion of the Work requires a trench excavation exceeding five (5) feet in depth, in accordance with Texas Health and Safety Code Section 756.023(a), Contractor shall fully comply, and shall require any applicable subcontractor to comply, with:

.1 The Occupational Safety and Health Administration standards for trench safety in effect for the construction of the Work;

.2 The special shoring requirements, if any, of the Owner; and

.3 Any geotechnical information obtained by Owner for use by the Contractor in the design of the trench safety system.

.4 Trench excavation safety protection shall be a separate pay item, and shall be based on linear feet of trench excavated. Special shoring requirements shall also be a separate pay item, and shall be based on the square feet of shoring used. Said cost shall be included within the Contract Sum.

§ 8.7.17 No delay or omission by Owner in exercising any right or power accruing upon the noncompliance or failure of performance by Contractor of any of the provisions of this Agreement shall impair any such right or power or be construed to be a waiver thereof. A waiver by Owner of any of the covenants, conditions or agreements hereof to be performed by Contractor shall not be construed to be a waiver of any subsequent breach thereof or of any other covenant, condition or agreement herein contained.

§8.7.18 Contractor stipulates that Owner is a political subdivision of the State of the Texas, and, as such, enjoys immunities from suit and liability as provided by the constitution and laws of the State of Texas. By entering into this Agreement, Owner does not waive any of its immunities from suit and/or liability, except as otherwise specifically provided herein, and as specifically authorized by law.

§ 8.7.19 By executing this Agreement, Contractor verifies that it does not boycott Israel, and it will not boycott Israel during the terms of this Contract.

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§ 8.7.20 Contractor verifies and affirms that it is not a foreign terrorist organization as identified on the list prepared and maintained by the Texas Comptroller of Public Accounts. If Contractor has misrepresented its inclusion on the Comptroller's list, such omission or misrepresentation will void this Contract »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

~~**.4** AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:~~
~~*(Insert the date of the E203-2013 incorporated into this Agreement.)*~~

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or

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proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

«**RFP/CONTRACTOR PROPOSAL.** »

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« » «President, Board of Trustees Birdville Independent School District »	« »« »
(Printed name and title)	*(Printed name and title)*

ATTEST:

Secretary, Owner's Board of Trustees
Birdville Independent School District

DRAFT

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AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

« »
« »

THE OWNER:
(Name, legal status and address)

«Birdville Independent School District »
«6125 East Belknap Street »
«Haltom City, Texas 76117 »

THE CONTRACTOR:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

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§ A.2.3 Required Property Insurance

§ A.2.3.1 Contractor shall provide builder's risk insurance as required in A.3.3.2.1. ~~Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.~~

§ A.2.3.1.1 [NOT USED] ~~**Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:~~

~~(Indicate below the cause of loss and any applicable sub-limit.)~~

~~Causes of Loss~~	~~Sub-Limit~~

§ A.2.3.1.2 [NOT USED] ~~**Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:~~

~~(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)~~

~~Coverage~~	~~Sub-Limit~~

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall ~~continue the insurance required by Section A.2.3.1 or, if necessary,~~ replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by ~~this~~ Section A.2.3.1.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1.3 have consented in writing to ~~the continuance of~~ replacement of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner ~~shall~~ may purchase and maintain, until the expiration of the period for correction of Work as set forth in

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Section 12.2.2 of the General Conditions, ~~"all-risks"~~ property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.3.~~2.~~3.~~21~~, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties. *(NOTE: Although this paragraph has been revised to make the District's purchase of property insurance optional, Districts are strongly advised to purchase such insurance if the District does not already have such insurance.)*

§ A.2.4 Optional Extended Property Insurance.

[NOT USED] ~~The Owner shall purchase and maintain the insurance selected and described below.~~
~~*(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)*~~

[« »] § A.2.4.1 ~~Loss of Use, Business Interruption, and Delay in Completion Insurance~~, ~~to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.~~

~~« »~~

[« »] § A.2.4.2 ~~Ordinance or Law Insurance~~, ~~for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.~~

~~« »~~

[« »] § A.2.4.3 ~~Expediting Cost Insurance~~, ~~for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.~~

~~« »~~

[« »] § A.2.4.4 ~~Extra Expense Insurance~~, ~~to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.~~

~~« »~~

[« »] § A.2.4.5 ~~Civil Authority Insurance~~, ~~for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.~~

~~« »~~

[« »] § A.2.4.6 ~~Ingress/Egress Insurance~~, ~~for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.~~

~~« »~~

[« »] § A.2.4.7 ~~Soft Costs Insurance~~, ~~to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.~~

~~« »~~

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§ A.2.5 Other Optional Insurance.

The Owner mayshall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[« »] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information.
(Indicate applicable limits of coverage or other conditions in the fill point below.)

« »

[« »] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) at least five business days after execution of the Contract documents and prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured ~~on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies~~on all of Contractor's insurance policies, except Contractor's workers compensation insurance. These certificates and the insurance policies required by this Article shall contain a provision that coverages afforded under the policies will not be canceled, reduced, or restricted for any reason, other than nonpayment of premium, until at least 30 days' prior written notice of such cancellation, reduction, or restriction has been given to the Owner and Contractor. An additional certificate, policy, and endorsement evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment, as required by Section 9.10.2 of the AIA A201-2017 General Conditions as amended for the Project, and thereafter upon renewal or replacement of such coverage. Information concerning reduction or restriction of coverage on account of revised limits or claims paid under the General Aggregate, or cancellation or expiration of the insurance shall be furnished by written notice to the Owner from~~by~~ the Contractor within three business days of the date Contractor knew or should have known of the cancellation, reduction, or restriction. At least 30 calendar days prior to the date of expiration of any required insurance policy, Contractor shall provide Owner written notice of the impending expiration. In addition, Contractor shall also provide copies of all policies, declarations, and endorsements for such insurance to Owner as required by Section 11.0.2 of the 2017 AIA A201 General Conditions as amended for this Project.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor. If the insurance required by this Section A.3.1 is subject to deductibles or self-insured retentions, the Contractor shall be responsible for all loss not covered because of such deductibles or retentions. For any claim made against the Contractor's policies of insurance, the deductible shall not exceed $2,500 for a Contract Sum (or Guaranteed Maximum Price, if the Project is a Construction Manager at Risk project), of less than $4 million. For a Contract Sum (or Guaranteed Maximum Price, if the Project is a Construction Manager at Risk project), of $4 million or more, the deductible shall not exceed $5,000.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage and any other insurance required by the Agreement, with the exception of Workers' Compensation insurance, to be endorsed to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or

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omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor and the Contractor's subcontractors shall purchase and maintain such insurance as will protect them and the Owner from claims which may arise out of, or result from, the Contractor's operations under the Contract whether such operations be by Contractor or by any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, in the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. (See also the insurance requirements included in Article 11 of the AIA A201-2017 General Conditions as amended for this Project.) The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions. ~~, unless a different duration is stated below:~~

~~*(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)*~~

The insurance required by this Section shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents. The limits of liability for such insurance shall be in at least the following amounts as specified below.

(NOTE: Amounts of insurance coverage have been left blank so that Districts can enter the appropriate amounts for their Projects. DO NOT LEAVE ANY BLANK UNFILLED IF THAT COVERAGE IS REQUIRED OR CHOSEN FOR THE PROJECT. If a particular coverage will not be used for the Project, delete the unused section. If the District has questions on the appropriate amounts or types of coverage, it is strongly suggested that the District contact its legal counsel and insurance agent.)

« »

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than «One Million Dollars and no/100 » ($ «1,000,000.00 ») each occurrence, «One Million Dollars and no/100 » ($ «1,000,000.00 ») general aggregate, and «Two Million Dollars and no/100 » ($ «2,000,000.00 ») aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness, or disease, including occupational sickness or disease, and death of any person, with a sublimit not less than $1,000,000 for medical expenses per person for bodily injury, included within the limits noted above;

.2 personal injury and advertising injury with a limit not less than $2,000,000.00;

.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;

.4 bodily injury or property damage arising out of the Work and out of completed operations, said coverage to be maintained for two years after Final Completion (to be maintained for a period of two years after Final Payment; Contractor shall continue to provide evidence of such coverage to Owner on an annual basis during this period and Owner shall be named by endorsement as an Additional Insured for such coverage) and must include Completed Operations coverage for Contractor, its sub-contractors, and Owner;

~~; and~~

.5 the Contractor's contractual liability, including but not limited to, indemnity obligations under Section 3.18 of the General Conditions~~.~~; and

.6 General Aggregate per Project endorsement.

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§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the Work involves such hazards.

.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned, hired, or any other vehicles used, by the Contractor, with policy limits of not less than « » ~~($ « »)~~ than those stated below per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage. *(Note: Texas statutory minimum for school districts is $100,000 per person, $300,000 per occurrence, and $100,000 property damage.)* Such minimum limits shall be stated as follows, or in a combined single limit policy in the amount of at least $1,000,000.

.1	Bodily Injury (per person)	$1,000,000
.2	Bodily Injury (per accident)	$1,000,000
.3	Property Damage	$1,000,000

§ A.3.2.4 The Contractor may not achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance. ~~, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and i~~In no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.4.1 Umbrella Excess Liability coverages shall be in at least the following amounts:

.1	$5,000,000	each occurrence
.2	$5,000,000	aggregate
.3	Aggregate Per Project Endorsement	

§ A.3.2.5 Workers' Compensation ~~at statutory limits~~.

.1	State:	Statutory Benefits

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.2	Employer's Liability:	$1,000,000	per accident
		$1,000,000	disease, policy limit
		$1,000,000	disease, each employee

§ A.3.2.5.1 Texas Workers' Compensation Insurance. A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Department of Insurance (TDI), or a coverage agreement (DWC-81, DWC-82, DWC-83, or DWC-84), showing statutory workers' compensation insurance coverage for the Contractor's employees providing services on a Project is required for the duration of the Project.

§ A.3.2.5.1.1 Duration of the Project includes the time from the beginning of the Work on the Project until the Contractor's work on the Project has been completed and accepted by the Owner.

§ A.3.2.5.1.2 Persons providing services on the Project ("subcontractor" in Texas Labor Code Section 406.096) include all persons or entities performing all or part of the services the Contractor has undertaken to perform on the Project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity that furnishes persons to provide services on the Project.

§ A.3.2.5.1.3 Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other services related to the Project. Services do not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

§ A.3.2.5.1.4 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code 401.011(44) for all employees of the Contractor providing services on the Project for the duration of the Project.

§ A.3.2.5.1.5 The Contractor must provide a certificate of coverage to the Owner prior to being awarded the Contract.

§ A.3.2.5.1.6 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the Project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the Owner showing that coverage has been extended.

§ A.3.2.5.1.7 The Contractor shall obtain from each person providing services on the Project, and provide to the Owner:

.1 A certificate of coverage, prior to that person beginning work on the Project, so the Owner will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

.2 No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project.

§ A.3.2.5.1.8 The Contractor shall retain all required certificates of coverage for the duration of the Project and for one year thereafter.

§ A.3.2.5.1.9 The Contractor shall notify the Owner in writing by certified mail or personal delivery, within ten days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project.

§ A.3.2.5.1.10 The Contractor shall post on each Project site a notice, in the text, form, and manner prescribed by the TDI, informing all persons providing services on the Project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

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§ A.3.2.5.1.11 The Contractor shall contractually require each person with whom it contracts to provide services on the Project to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code 401.011(44) for all of its employees providing services on the Project for the duration of the Project;

.2 Provide to the Contractor, prior to that person beginning work on the Project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project for the duration of the Project;

.3 Provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

.4 Obtain from each other person with whom it contracts, and provide to the Contractor:

.1 A certificate of coverage, prior to the other person beginning work on the Project; and

.2 A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

.5 Retain all required certificates of coverage on file for the duration of the Project and for one year thereafter;

.6 Notify the Owner in writing by certified mail or personal delivery, within ten days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and

.7 Contractually require each person with whom it contracts to perform as required by items 1-6, with the certificates of coverage to be provided to the person for whom they are providing services.

§ A.3.2.5.1.12 By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the Owner that all employees of the Contractor who will provide services on the Project will be covered by workers' compensation coverage for the duration of the Project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the TDI's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

§ A.3.2.5.1.13 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor that entitles the Owner to declare the Contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the Owner.

§ A.3.2.5.1.14 The coverage requirement recited above does not apply to sole proprietors, partners, and corporate officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996.

28 TAC § 110.110(i)

§ A.3.2.6 Employers' Liability with policy limits not less than «One Million Dollars and no/100 » ($ «1,000,000.00») each accident, «One Million Dollars and no/100 » ($ «1,000,000.00 ») each employee, and «One Million Dollars and no/100 » ($ «1,000,000.00 ») policy limit.

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§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than «One Million Dollars and no/100 » ($ «1,000,000.00 ») per claim and «Two Million Dollars and no/100 » ($ «2,000,000.00 ») in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[« X »] **§ A.3.3.2.1** ~~P~~Builder's Risk Property insurance ~~of the same type and scope satisfying the requirements identified in Section A.2.3,~~ which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. ~~The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below.~~ The Contractor shall disclose to the Owner the amount of any deductible, and the ~~Owner~~Contractor shall be responsible for losses within the deductible. ~~Upon request, t~~The Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

~~*(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)*~~

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«»

.1 Builder's Risk. Unless otherwise provided Contractor shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the state of Texas a property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis , including boiler and machinery insurance, Coverage, if not included in the base coverage, shall include coverage against the perils of fire, (with extended coverage) and physical loss or damage including, without limitation or duplication of coverage, lightning, collapse, earthquake, flood, wind storm, hurricane, hail, explosion, riot, civil commotion, smoke, aircraft, land vehicles, theft, vandalism, malicious mischief, falsework, testing and start-up, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and all other perils, and shall include materials stored on-site, off-site and in transit. The Contractor's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion; and thereafter, as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

.2 Causes of Loss. The insurance required by this Section A.3.3.2.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(*Indicate below the cause of loss and any applicable sub-limit.*)

.3 Causes of Loss Sub-Limit. Specific Required Coverages. The insurance required by this Section A.3.3.2.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows: *(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)*

.4 Coverage Sub-Limit. Unless the parties agree otherwise, upon Substantial Completion, the Contractor shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

.5 Adjustment of Loss. The Owner, as fiduciary, shall have power to adjust and settle any loss arising out of the Work, with insurers, regardless of the purchaser of the insurance policy. The Contractor, upon receipt of proceeds, shall, as a fiduciary, pay all subcontractors their just shares of insurance proceeds received by the Contractor, and, by appropriate agreements, shall require subcontractors to make payment to their sub-subcontractors in similar manner. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, then replacement of damaged property shall be performed by the Contractor with the insurance proceeds upon issuance of a Notice to Proceed from the Owner.

.6 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

.7 Insurance for Existing Structures If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Contractor shall purchase and maintain, until the

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expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Contractor shall be responsible for all co-insurance penalties.

.8 Employee Theft or Dishonesty. If this Builder's Risk policy excludes Employee Theft or Dishonesty coverage, including Third Parties, Contractor shall obtain separate coverage sufficient to protect Owner's interest and in an amount agreeable to Owner.

.9 Cancellation. The insurance policies required by this Section A.3.3.2 shall contain a provision that coverages afforded under the policies will not be canceled for any reason, other than nonpayment of premium, or reduced or restricted due to a material change in coverage until at least 30 days' prior written notice of such cancellation or material change has been given to the Owner. Contractor shall provide Owner 30 days prior written notice of the expiration of any policy required by Section A.3.1.1.

.10 Construction Manager at Risk. If Contractor is a Construction Manager at Risk, then, as specified in each AIA A133 Exhibit A Amendment, the amount of Builder's Risk insurance coverage shall be an amount equal to the Guaranteed Maximum Price; otherwise, in the total amount of the Contract Sum.

.11 Deductibles. For any claim made against the builder's risk insurance, the deductible shall not exceed $2,500 for a Contract Sum (or Guaranteed Maximum Price, if the Project is a Construction Manager at Risk project), of less than $4 million. For a Contract Sum (or Guaranteed Maximum Price, if the Project is a Construction Manager at Risk project), of $4 million or more, the deductible shall not exceed $5,000. Contractor shall be responsible for losses within such deductible amounts.

[« »] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate, for Work within fifty (50) feet of railroad property.

[« »] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[« »] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[« »] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[« »] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond
The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, subject to the requirements of A201-2017, Article 11.1.2.~~3~~1, as follows:
(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	
Performance Bond	

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The form of Payment and Performance Bonds shall be subject to the requirements of Texas law~~AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™,~~ current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

«See A201-2017, Article 11 »

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« » «President, Board of Trustees » *(Printed name and title)*	« »« » *(Printed name and title)*
Birdville Independent School	

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DOCUMENT 00 61 13.13

PERFORMANCE BOND FORM **Bond No.: _____**

(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: _____
(hereinafter called the Principal), as principal, and
a corporation organized and existing under the laws of the State of _____ authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this _____ day of _____, _____.

SMITHFIELD MS - GYMNASIUM ADDITION
BIRDVILLE ISD
NORTH RICHLAND HILLS, TEXAS

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____ day of _____, _____.

_____ (Seal)
Principal

_____
Surety Address

By: _____

_____ (Seal)
Surety

_____
Surety Telephone Number

By: _____
Attorney-in-Fact

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DOCUMENT 00 61 13.16

PAYMENT BOND FORM **Bond No.: _____**
(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: _____
(hereinafter called the Principal), as principal,
a corporation organized and existing under the laws of the State of _____ authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this _____ day of _____, _____.

SMITHFIELD MS - GYMNASIUM ADDITION
BIRDVILLE ISD
NORTH RICHLAND HILLS, TEXAS

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all claimants supplying labor and material to him or a Subcontractor in the prosecution of the work provided for in said contract, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas Government Code and all liabilities on this bond to all such claimants shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____ day of _____, _____.

Witness: _____ (Seal)
Principal

_____ By: _____

Witness: _____ (Seal)
Surety

_____ By: _____
Attorney-in-Fact

_____

_____ _____
Surety Address Surety Telephone Number

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DOCUMENT 00 62 00

AFFIDAVIT OF NON-ASBESTOS, LEAD, AND PCB USE IN PROJECT

Upon completion of this form, return to the Architect upon close-out of the project.

PROJECT NAME:

Smithfield MS - Gymnasium Addition

Architect's Project Number: 1887.00

OWNER NAME: Birdville Independent School District Phone No. 817.547.5700

Address: _____

The undersigned affirms and certifies that "to the best of their knowledge and belief asbestos, lead, and PCB containing materials have not been used or incorporated into the Work and lead or lead bearing materials have not been incorporated into potable water systems", including, but not limited to those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibbs, as applicable to the project, and that lead sheet flashing used in through roof plumbing penetration applications is the only lead on the Project.

_____
Name of Contractor or Subcontractor

STATE OF TEXAS)
)
COUNTY OF _____)

Sworn to and subscribed before me at _____, Texas, this the _____ day of _____, _____.

Notary Public in and for _____ County, Texas

END OF SECTION

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DOCUMENT 00 65 00

RELEASE OF LIEN DOCUMENTS

APPENDIX INDEX:

[Note: the attached forms are duplicated *verbatim* (without editing) from HB 1456.]

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENTS

* * * * * * *

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

Project:

Job No.:

On receipt by the signer of this document of a check from _____
_____
(maker of check) in the sum of $_____
payable to _____
(payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____
_____
(owner) located at (location) to the following extent: _____
_____
_____
_____(job description).

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____
(person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date: _____

_____(Company name)

By _____(Signature)

_____(Title)

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS

* * * * * * *

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

Project:

Job No.:

The signer of this document has been paid and has received a progress payment in the sum of $_____ for all labor, services, equipment, or materials furnished to the property or to _____
(person with whom signer contracted) on the property of _____
(owner) located at _____
(location) to the following extent:_____
_____
_____
(job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent: _____
_____
_____

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____
(person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in **full** all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date: _____

_____(Company name)

By _____(Signature)

_____(Title)

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENT

* * * * * * *

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project:

Job No.:

On receipt by the signer of this document of a check from _____
_____
_____(maker of check) in the sum of
$_____ payable to
_____
_____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____
_____
(owner) located at _____
_____
(location) to the following extent:_____
_____
_____(job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to _____
(person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date: _____

_____(Company name)

By _____(Signature)

_____(Title)

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENT

* * * * * * *

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project:

Job No.:

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to_____
_____
(person with whom signer contracted) on the property of_____
_____
_____ (owner) located at_____
_____
_____ (location) to the following extent _____
_____
:_____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date: _____

_____(Company name)

By _____(Signature)

_____(Title)

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

« »

THE OWNER:
(Name, legal status and address)

«Birdville Independent School District »
«6125 East Belknap Street
Haltom City, Texas 76117 »

THE CONTRACTOR:
(Name, legal status and address)

« »« »

THE ARCHITECT:
(Name, legal status and address)

« »« »

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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INDEX
(Topics and numbers in bold are Section headings.)

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), all sections of the Project Manual and Construction Documents (as defined in §1.1.3 below) including Drawings, Specifications, and Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. ~~Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.~~ Any reference to Contract Documents herein shall include the Construction Documents, and any other documents included in the Contract Documents, as amended and/or supplemented for this Project.

§ 1.1.1.1 The Agreement, represents the entire and integrated agreement between the Owner and the Contractor and supersedes all prior negotiations, representations or agreements, either written or oral. Any revision, amendment, or modification to the Standard Form of the Agreement shall be valid, binding, and enforceable only if said revision, amendment or modification is made conspicuous by being underlined, lined-through, or highlighted in this Agreement signed by Contractor and the authorized representative of Owner's Board of Trustees. In the event of conflict, terms and conditions contained in the Agreement, shall take precedence over terms and conditions contained in the General Conditions, and the terms and conditions in the General Conditions, shall take precedence over all other terms and conditions contained in the other Contract Documents. If the Request for Proposals and the Proposal are included in the Contract Documents, then the Request for Proposals shall take precedence over the Proposal, unless specifically agreed otherwise herein.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a written Modification signed by Contractor, approved by Owner's Board of Trustees, and signed by the representative of the Owner's Board of Trustees who is authorized to sign contracts. As a material consideration for the making of the Contract, modifications to the Contract shall not be construed against the maker of said modifications. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. ~~The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.~~

§ 1.1.2.1 To be effective, all Contract Documents requiring signatures must be signed first by the Contractor and then by the Owner's authorized representative, after approval by Owner's Board of Trustees. If an approved Contract Document requiring Contractor's signature has not been signed, then the missing signature shall be provided within a reasonable period of time. Failure of Contractor to sign an approved Contract Document after notice and a reasonable opportunity to sign shall be considered a material breach of the Contract by Contractor.

§ 1.1.3 The Work; Construction Documents

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. The Work includes all of Contractor's responsibilities as to all labor, parts, supplies, skill, supervision, transportation services, storage requirements, and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the Contract Documents and the Construction Documents and all other items of cost or value needed to produce, construct and fully complete the public Work identified by the Contract Documents and the Construction Documents. "Construction Documents" means: all Drawings, Specifications, geotechnical reports, Addenda, submittals, transmittals, deliverables, instructions to Contractors, and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants and which set forth in detail the

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requirements for construction of the Project. The Construction Documents shall include Drawings and Specifications that establish in detail the quality levels of materials and systems required for the Project. The Construction Documents shall reflect all agreements between Owner and Architect concerning Owner's budgetary constraints, programmatic needs and expectations as to quality, functionality of systems, maintenance costs, and usable life of equipment and facilities. Said Construction Documents shall reflect the Owner's educational program and educational specifications, the State educational adequacy standards in 19 TAC Section 61.1036 and the standards set forth in Section 3.1.4 of AIA Document B101-2017. The Architect shall provide Construction Documents which are sufficient for Owner to complete construction of the Project, are free from material defects or omissions, and which shall comply with all applicable laws, ordinances, codes, rules, and regulations, as of the date of issuance of Construction Documents.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 ~~Instruments of Service~~Construction Documents

~~Instruments of Service~~Construction Documents ~~are~~include representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. ~~Instruments of Service~~ Construction Documents may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 ~~Initial Decision Maker~~

~~The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.~~

§ 1.1.9 Addenda

Addenda are written or graphic instruments issued prior to the execution of the Contract, which modify or interpret the bidding or proposal documents, including Drawings and Specifications, by additions, deletions, clarifications, or corrections. Addenda will become part of the Contract Documents and Construction Documents when the Agreement is executed. The Contractor and subcontractors shall include all addenda items on their copies of the Drawings and Specifications.

§ 1.1.10 All references to "Contractor" shall include "Construction Manager at Risk" as appropriate.

§ 1.1.11 The Owner may retain Program Manager(s) to carry out some of the functions of the administration of the Owner's construction program. The Contractor, Architect, and Program Manager (when applicable) shall cooperate with each other in the performance of their respective functions. The management and reporting systems used by the Owner and/or Program Manager, including the assignment of the Program Manager, may be changed by Owner during the Project.

§ 1.1.12 Approved, Approved Equal, Approved Equivalents, Or Equal

The terms "Approved" and "Approved Equal" relate to the substitution of materials, equipment, or procedure in writing by the Architect prior to receipt of bids.

§ 1.1.13 Abbreviations

AIA: American Institute of Architects. (All references to AIA documents refer to AIA's trademarked documents. Each reference to a specific document shall refer to the document as amended for this Project.)

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AIEE: American Institute of Electrical Engineers
ACI: American Concrete Institute
AHERA: Asbestos Hazardous Emergency Response Act
AISI: American Iron and Steel Institute
AISC: American Institute of Steel Construction
ANSI: American National Standards Institute
ASA: American Standards Association
ASTM: American Society of Testing Materials
AWSC: American Welding Society Code
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
EPA: Environmental Protection Agency
FS: Federal Specification
NEC: National Electrical Code
OSHA: Occupational Safety and Health Administration
SPR: Simplified Practice Recommendation
TAS: Texas Accessibility Standards
UL: Underwriters Laboratories, Inc.

§ 1.1.14 Bids or Bidding The terms "Bids" or "Bidding" shall include any kind of competitive purchasing under Texas Government Code Chapter 2269.

§ 1.1.15 Miscellaneous Other Words

§ 1.1.15.1 Business Day
The term "business day" is a day the Owner's Administration Building is scheduled to be open for normal business purposes, unless closed by the Owner's Superintendent of Schools for inclement weather or other reason. Days on which the Administration Building is normally closed are Thanksgiving Break, Winter Break, Spring Break, and Summer Break, as well as other federal, state or local days specified in the calendar approved by the Owner's Board of Trustees on an annual basis. A business day does not include a day on which the Owner's Administration Building is open only for the purposes of conducting candidate filing, early voting, elections, or other special events.

§ 1.1.15.2 Calendar Day
A calendar day is a day on the Gregorian Calendar. The Contract Time is established in calendar days. Extensions of time granted, if any, will be converted to calendar days.

§ 1.1.15.3 Holidays
Owner-approved holidays for Contractor's Work are limited to New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.

§ 1.1.15.4 Work Day
Work days are all calendar days except Holidays.

§ 1.1.15.5 Anticipated Weather Days
An allowance of regular Work Days, established as anticipated Work Days lost due to weather delays; said allowance shall be included in Contractor's proposed completion time. Only lost weather days in excess of Anticipated Weather Days shall be considered by Owner for time extensions based upon weather. Section 15.1.5.3 lists required Anticipated Weather Days.

1.1.16 Contract Sum
"Contract Sum" shall have the same meaning as in Section 5.1 of the Agreement (A133-2009), for the Project when the Project is a Construction Manager at Risk Project, and the same meaning as in Article 4 of the Agreement (A101-2017) for the Project.

§ 1.2 Correlation and Intent of the Contract Documents
§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

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consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.1.2 During the course of the Work, should any conflict be found in or between the Contract Documents, the Contractor shall be deemed to have estimated the Work on the basis of the greater quantity or better quality, or the most stringent requirement, unless he shall have obtained an interpretation in writing from the Architect as to what shall govern before the submission of his Proposal. The Architect, in case of such conflict, may interpret or construe the documents so as to obtain the most substantial and complete performance of the Work consistent with the Contract Documents and reasonably inferable therefrom, in the best interest of Owner, and the Architect's interpretation shall be final. The terms and conditions of this clause shall not relieve any party of any other obligation under the Contract Documents.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 Relation Of Specifications And Drawings

General Requirements in the Specifications govern the execution of all Specifications. Summary paragraphs present a brief indication of the Work, but do not limit the Work as later detailed. The Drawings and Specifications are correlative and have equal authority and priority. Should the Drawings and Specifications have internal inconsistencies, then the Contractor shall base the bids and construction on the more expensive combination of quality and quantity of work indicated. For purposes of construction, the Architect shall determine the appropriate Work, after the Contractor brings the inconsistency to the Architect's attention. Failure to report an inconsistency shall be evidence that Contractor has elected to proceed in the more expensive manner.

§ 1.2.5 Materials, Equipment And Processes

Exact location and arrangement of the various pieces of equipment specified shall be determined with the approval of the Architect after equipment has been selected and/or as the Work progresses. All equipment shall, insofar as possible, be installed in such a manner as will not interfere with architectural or structural portions of the building. Should changes become necessary because of a failure of the Contractor to comply with the Contract Documents which results in equipment requiring more area then shown on the Contract Documents, the Contractor shall be fully responsible for completing any required modifications or eliminating any interferences. Where in the Drawings and Specifications, certain products, manufacturer's trade names, or catalog numbers are specified, it is done for the express purpose of establishing a standard of function, dimension, appearance, and quality of design in harmony with the Work, and is not intended for the purpose of limiting competition. Materials or equipment shall not be substituted unless the Architect has specifically accepted such substitution for use on this Project. When more than one material, process, or brand is specified for a particular item of Work, the choice shall be the Contractor's. The final selection of color and pattern will be made by the Owner from the range available within the option selected by the Contractor, unless the item is specified to match a specific color or sample furnished. Where particular items are specified, products of those named manufacturers are required unless Contractor submits for consideration proposed substitutions of materials, equipment or processes from those set out in the Contract Documents. Submittals of proposed substitutions should contain sufficient information to allow the Architect and Owner to determine if the proposed substitution is in fact equal to or better than the requirements in the Contract Documents. The Architect shall review and respond to proposed substitutions within fifteen (15) days of receipt. Contractor shall bear all risk caused by submitting substitutions, including all costs. The Owner may approve substitutions only when the substitution is clearly provided by the Contract to be equal in performance characteristics to the requirements of the Contract Documents, equally compatible with the existing installations and complementary to the architectural design for the Work. Certain specified construction and equipment details may not be regularly included as part of

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the named manufacturer's standard catalog equipment, but shall be obtained by the Contractor from the manufacturer as required for the proper evaluation and/or functioning of the equipment. Reasonable minor variations in equipment are expected and will be acceptable, if approved by the Architect and Owner, however, indicated and specified performance and material requirements are the minimum. The Owner and the Architect reserve the right to determine the equality of equipment and materials that deviate from any of the indicated and specified requirements.

§ 1.2.6 Standards And Requirements

When the Contract Documents refer to standards, building codes, manufacturers' instructions, or other documents, unless otherwise specified, then the current edition as of the date of execution of the Agreement by the last party to execute said Agreement shall apply. It shall be the responsibility of the Architect to address revisions or amendments to applicable codes or standards which arise after the date of execution of the Agreement and until Final Completion, pursuant to the terms of the Agreement between Owner and Architect. Requirements of public authorities apply as minimum requirements only and do not supersede more stringent specified requirements.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other ~~Instruments of Service~~Construction Documents

§ 1.5.1 ~~The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights.~~ All ownership rights, whether common law, statutory, or other reserved rights, including copyright ownership of the Construction Documents, are controlled by the Agreement between the Owner and the Architect. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the ~~Instruments of Service~~Construction Documents. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of any ~~the Architect's or Architect's consultants'~~ reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are granted a limited license ~~authorized~~ to use and reproduce the ~~Instruments of Service~~Construction Documents provided to them, subject to any protocols established pursuant to Section~~s~~ 1.7~~, and 1.8,~~ solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the ~~Instruments of Service~~Construction Documents. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the ~~Instruments of Service~~Construction Documents on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants. All copies of the Construction Documents, except the Contractor's record set, shall be returned or suitably accounted for to the copyright holder upon completion of the Work.

§ 1.6 Notice~~Transmission of Data in Digital Form~~

~~If the parties intend to transmit Construction Documents or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.~~

§ 1.6.1 ~~Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.~~ Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice, or if sent by electronic facsimile transmission, to the last business number known to the party giving

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notice, with electronic confirmation of receipt; or, if sent by electronic mail, to the email address of the Owner's or Contractor's designated representative, with electronic confirmation of receipt.

§ 1.6.2 ~~Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.~~

§ 1.7 Digital Data Use and Transmission

~~The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.~~ If the parties intend to transmit Construction Documents or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents

§ 1.8 ~~Building Information Models Use and Reliance~~

~~Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.~~

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the independent school district identified in the Contract Documents. ~~person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.~~ The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to: enter into a contract; amend a contract, including but not limited to AIA Document A-133 Exhibit A; approve changes in the scope of Work; approve and execute a Change Order or Construction Change Directive modifying the Contract Sum or Guaranteed Maximum Price; agree to an extension to the date of Substantial or Final Completion; or terminate a contract. The Board will act as soon as reasonably possible to avoid undue delays. The Board designates authorized representatives to act on its behalf for day-to-day operations under the Contract. Unless otherwise designated in the Contract Documents, Owner's authorized representative shall be the Superintendent of Schools, who may delegate responsibilities as appropriate. Owner's Board of Trustees hereby delegates to the Superintendent of Schools or designee the authority to approve changes to the Work where such changes are within the Owner's contingency or the Contractor's contingency, and which do not exceed $25,000.00, or will not increase the dates for Substantial or Final Completion by more than ten (10) days. Any such change shall be confirmed in writing between the Contractor and Owner's Superintendent or designee, and notice of such approved changes shall be given to the Board at its next regular meeting. Except as otherwise provided in the Contract Documents, the Architect does not have such authority. Neither Architect nor Contractor may rely upon the direction of any employee of Owner who has not been designated in writing by the Superintendent or Board of Trustees; Owner shall not be financially responsible for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons.

§ 2.1.2 ~~The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.~~ It shall be distinctly understood that by virtue of this Contract, no mechanic, contractor, material person, artisan, or laborer, skilled or unskilled, shall ever in any manner have, claim, or acquire any lien upon the buildings or any of the improvements of whatsoever nature or kind so erected or to be erected by virtue of this Contract or upon any of the land on which said buildings or any of the improvements are so erected, built, or situated, such property belonging to a political subdivision of the State of Texas. It shall be further understood that this Contract is not written for the benefit of third parties.

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§ 2.1.3 The Owner shall require the Contractor and the Architect to meet periodically at mutually-agreed-upon intervals, for the purpose of establishing procedures to facilitate cooperation, communication, and timely responses among the participants. By participating in this arrangement, the parties do not intend to create additional contractual obligations or modify the legal relationships which may otherwise exist.

§ 2.1.4 The Owner may require that the Contractor use and/or respond to certain Owner-furnished forms or inquiries during the course of the Project. From time to time, there may be future revisions, changes, additions or deletions to these forms. The fact that the Owner modifies and increases reasonable reporting requirements shall not serve as the basis for a claim for additional time or compensation by the Contractor.

§ 2.1.5 The Contractor stipulates and agrees that the Owner has no duty to discover any design errors or omissions in the Drawings, Plans, Specifications and other Construction Documents, and has no duty to notify Contractor of same. By entering into the Contract Documents or any Agreement with any Architect, Owner does not warrant the adequacy and accuracy of any Drawings, Plans, Specifications or other Construction Documents.

§ 2.2 ~~Evidence of the~~ Owner's Financial Arrangements

§ 2.2.1 ~~Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.~~ The Owner, being a public body under the laws of the State of Texas, must have adequate funds and/or financing as provided by law prior to award and execution of the Contract Documents.

§ 2.2.2 ~~Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~

§ 2.2.3 ~~After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.~~

§ 2.2.4 ~~Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.~~

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor ~~to whom the Contractor has no reasonable objection and~~ whose status under the Contract Documents shall be that of the Architect. Owner shall notify Contractor if a ~~new~~ successor ~~A~~architect has been employed by Owner.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. ~~The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.~~ Other than the metes and bounds noted in the survey, if any, Owner does not guarantee or warrant the accuracy of surveys provided, including the locations of utility lines, cables, pipes or pipelines, or the presence or absence of easements.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. ~~The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness~~ after receiving the Contractor's written request for such information or services. Absent such timely notification, any Claim based upon lack of such information or services shall be waived.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor at least one copy of the ~~Contract~~ Construction Documents, as provided for in the Project Manual, for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct defective Work, fails to correct Work that is not in accordance with the requirements of the Contract Documents or the Construction Documents as required by Section 12.2, or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. The authorized Owner's representative having the legal right to stop the Work shall be limited to the Owner's Superintendent of Schools.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. ~~Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and t~~The Architect ~~may~~shall, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's and other consultants' additional services, if any, made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, then the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, then the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative, and includes the Construction Manager at Risk, if applicable.

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§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, activities of the Owner (or Owner's Program Manager, if applicable), or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 The Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute this Contract, which representations and warranties shall survive the execution and delivery of the Contract and the Final Completion of the Work:

.1 that it is financially solvent, able to pay its debts as they mature, and possessed of sufficient working capital to complete the Work and perform its obligations under the Contract Documents;

.2 that it is able to furnish the tools, materials, supplies, equipment and labor required to timely complete the Work and perform its obligations hereunder and has sufficient experience and competence to do so;

.3 that it is authorized to do business in the State where the Project is located and properly licensed by all necessary governmental, public, and quasi-public authorities having jurisdiction over it, the Work, or the site of the Project; and

.4 that the execution of the Contract and its performance thereof are within its duly-authorized powers.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents. The Contractor represents and warrants by submission of a Proposal that he has carefully examined the Contract Documents, any soil test reports, drainage studies, geotechnical or other reports, and the site of the Work, and that, from his own investigations, he has satisfied himself as to the nature and location of the Work, the character, quality and quantity of surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the Work, the general and local conditions and all other materials which may in any way affect the Work or its performance. Should the Contractor find discrepancies, omissions or conflicts within the Contract Documents, or be in doubt as to their meaning, the Contractor shall at once notify in writing the Architect and Owner, and Architect will issue a written addendum to all parties that is consistent with the Owner's Scope of the Work. The Contractor shall not be entitled to any additional time or compensation for Contractor's failure to visit the site, or for any additional Work caused by the Contractor's fault, by improper construction, or by Contractor's failure to visit the site or to carefully study and compare the Contract Documents prior to execution of the Work.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are ~~not~~ for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; ~~however,~~ the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. Contractor shall not perform any Work involving an error, inconsistency, or omission without further instructions to Contractor or revised Construction Documents from the Architect.

§ 3.2.3 Neither the Owner nor ~~T~~the Contractor is ~~not~~ required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public

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authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the Work or to honor his warranty, or will result in a limitation of or interference with the Owner's intended use, then the Contractor shall promptly notify the Architect and Owner in writing, providing substantiation for his position. Any necessary changes, including substitution of materials, shall be accomplished by appropriate Modification. If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. Contractor shall take field measurements, verify field conditions, ad shall carefully compare them to the Construction Documents. ~~If the Contractor performs those obligations, T~~the Contractor shall ~~not~~ be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities when the Contractor recognized or should have recognized such error, inconsistency, omission or difference and failed to report it to the Architect. Contractor shall not be entitled to additional compensation for additional Work caused by Contractor's failure to carefully study and compare the Construction Documents prior to the execution of the Work.

§ 3.2.5 Prior to performing any Work, and only if applicable, Contractor shall locate all utility lines as shown and located on the plans and specifications, including telephone company lines and cables, sewer lines, water pipes, gas lines, electrical lines, including, but not limited to, all buried pipelines and buried telephone cables, and shall perform any Work in such a manner so as to avoid damaging any such lines, cables, pipes, and pipelines. In addition, Contractor shall independently determine the location of same. Contractor shall be responsible for any damage done to such utility lines, cables, pipes and pipelines during its Work, and shall be responsible for any loss, damage, or extra expense resulting from such damage. Repairs shall be made immediately to restore all service. Any delay for such break shall be attributable to Contractor. In addition, and only if applicable, Contractor shall review the appropriate AHERA and hazardous materials surveys for the particular campuses involved in the Project, and shall notify all Subcontractors and Sub-subcontractors of the necessity to review said surveys. Contractor shall perform any Work in such a manner as to avoid damaging, exposing, or dislodging any asbestos-containing materials that are clearly identified and located in AHERA and other hazardous material surveys. Before performing any portion of the Work, the Contractor shall fully investigate all physical aspects of the Project Site and verify all dimensions, measurements, property lines, grades and elevations, existing improvements, and general suitability of existing conditions at the Project site. If applicable, Contractor shall comply with U.S. Environmental Protection Agency rules concerning renovating, repairing, or painting work in schools built prior to 1978 involving lead-based paint.

§ 3.2.6 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation. If, in the reasonable opinion of the Architect, the Contractor does not make reasonable effort to comply with any of the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure.

§ 3.2.7 The Contractor shall arrange meetings prior to commencement of the Work of all major Subcontractors to allow the Subcontractors to demonstrate an understanding of the Construction and Contract Documents to the Architect and to allow the Subcontractors to ask for interpretations, when necessary. The Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including:

.1 The location, condition, layout, drainage and nature of the Project site and surrounding areas;
.2 Generally prevailing climatic conditions;

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.3 Anticipated labor supply and costs;
.4 Availability and cost of materials, tools and equipment; and
.5 Other similar issues.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects in writing to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors. As part of that responsibility, Contractor shall enforce the Owner's alcohol-free, drug-free, tobacco-free, harassment-free and weapon-free policies and zones, which will require compliance with those policies and zones by Contractor's employees, subcontractors, and all other persons carrying out the Contract. Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, while on Owner's property, to refrain from committing any criminal conduct, using tobacco products, possessing or drinking alcoholic beverages, possessing or using illegal drugs or any controlled substance, carrying or possessing weapons, speaking profane and/or offensive language, or engaging in any inappropriate interactions of any nature whatsoever with students and employees, including talking, touching, staring or otherwise contributing to a hostile or offensive environment for Owner's students and employees. All areas of campus, other than the defined construction area, shall be off limits to Contractor's forces, unless their work assignment specifies otherwise. Contractor shall also require adequate and appropriate dress and identification of Contractor's employees, subcontractors, and all other persons carrying out the Work. Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, to wear identification tags on the front of their persons during all times that they are on Owner's property. Such identification tags shall contain a current photograph and the worker's full name in a typeface large enough to be seen from a reasonable distance. The Contractor shall further ensure that no on-site fraternization shall occur between personnel under the Contractor's and Subcontractor's direct or indirect supervision and Owner's students or employees and the general public. Failure of an individual to adhere to these standards of conduct shall result in the immediate removal of the offending employee from all construction on any of Owner's property. Repeated removal of Contractor's or Contractor's subcontractor's forces, or one serious infraction, shall constitute a substantial breach of the Agreement justifying the immediate termination by Owner pursuant to Article 14. Contractor shall require all construction workers, whether Contractor's own forces or the forces of Contractor's subcontractors, to park their personal motor vehicles on Owner's property only in the parking places designated by the Owner's campus principal. Any vehicles not parked in the appropriate locations shall be towed at the vehicle owner's sole expense. Contractor shall follow, and shall require all employees, agents or subcontractors to follow, the tree ordinance of the municipality in which the Project is located. In addition, if not covered by the municipal tree ordinance, Contractor shall barricade and protect all trees on the Project, which shall be included in the Cost of the Work. Contractor shall institute a theft deterrence program designed to restrict construction worker access to properties of Owner that are currently in use, to maintain supervision of Contractor's and Contractor's subcontractor's forces, and to reimburse the Owner or those persons suffering a theft loss which results from Contractor's forces or Contractor's subcontractor's forces' actions, omissions, or failure to secure the Work or connecting or adjacent property of Owner.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

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§ 3.3.4 The Contractor shall properly and efficiently coordinate the timing, scheduling and routing of all Work performed by all sub-contractors and sub-sub-contractors.

§ 3.3.5 To the extent that any portion of the Work requires a trench excavation exceeding five (5) feet in depth, in accordance with Texas Health and Safety Code Section 756.023(a), Contractor shall fully comply, and shall require any applicable subcontractor to comply, with:

.1 The Occupational Safety and Health Administration standards for trench safety in effect for the Construction of the Work;

.2 The special shoring requirements, if any, of the Owner; and

.3 Any geotechnical information obtained by Owner for use by the Contractor in the design of the trench safety system.

.4 Trench excavation safety protection shall be a separate pay item, and shall be based on linear feet of trench excavated. Special shoring requirements shall also be a separate pay item, and shall be based on the square feet of shoring used.

§ 3.3.6 The Contractor shall review Subcontractor safety programs, procedures, and precautions in connection with performance of the Work. However, the Contractor's duties shall not relieve any Subcontractor(s) or any other person or entity (e.g., a supplier), including any person or entity with whom the Contractor does not have a contractual relationship, of their responsibility or liability relative to compliance with all applicable federal, state, and local laws, rules, regulations, and ordinances which shall include the obligation to provide for the safety of their employees, persons, and property and their requirements to maintain a work environment free of recognized hazards. The foregoing notwithstanding, the requirements of this Paragraph are not intended to impose upon the Contractor any additional obligations that the Contractor would not have under any applicable state or federal laws, including, but not limited to, any rules, regulations, or statutes pertaining to the Occupational Safety and Health Administration.

§ 3.3.7 It is understood and agreed that the relationship of Contractor to Owner shall be that of an independent contractor. Nothing contained in this Agreement or inferable from this Agreement shall be deemed or construed to: 1) make Contractor the agent, servant or employee of the Owner; or 2) create any partnership, joint venture, or other association between Owner and Contractor. Any direction or instruction by Owner or any of its authorized representatives in respect of the Work shall relate to the results the Owner desires to obtain from the Work, and shall in no way affect Contractor's independent contractor status.

§ 3.3.8 Pursuant to Texas Labor Code Sec. 214.008, the Contractor and any subcontractor on the Project shall properly classify, as an employee or an independent contractor, in accordance with Texas Labor Code Chapter 201, any individual the Contractor or subcontractor directly retains and compensates for services performed in connection with this Agreement. Any Contractor or subcontractor who fails to properly classify such an individual may be subject to the penalties of Texas Labor Code Sec. 214.008(c).

§ 3.4 Labor and Materials

§ 3.4.1 These Contract Documents shall not be construed to deny or diminish the right of any person to work because of the person's membership or other relationship status with respect to any organization. Texas Government Code §2269.054. Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for qualified, careful, and efficient workers and labor, eligible to work in accordance with state and federal law. Contractor shall appropriately classify all workers in accordance with the Fair Labor Standards Act, its implementing regulations, and Texas Labor Code Section 214.008. In addition, unless otherwise provided in the Contract documents, the Contractor shall provide and pay for materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Before ordering any material or doing any Work, Contractor shall verify all dimensions and check all conditions in order to assure Contractor that they are the same as those in the Drawings, Specifications, and other Construction Documents. Any inconsistency shall be brought to the attention of the Architect. In the event that

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discrepancies occur between ordered material and actual conditions and Architect was not notified beforehand, then costs to correct such discrepancies shall be borne by Contractor.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the prior written consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.2.1 After evaluation by the Architect, substitutions and alternates may be rejected by the Architect without explanation and will be considered only under one or more of the following conditions: (i) the proposal is required for compliance with interpretation of code requirements or insurance regulations then existing; (ii) specified products are unavailable through no fault of the Contractor; (iii) and when, in the judgment of the Architect, a substitution would be substantially in the Owner's best interests, in terms of cost, time, or other considerations.

§ 3.4.2.2 The Contractor must submit to the Architect: (i) a full explanation of the proposed substitution and submittals of all supporting data, including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation for the substitution; (ii) a written explanation of the reasons the substitution should be considered, including the benefits to the Owner and the Work in the event the substitution is acceptable; (iii) the adjustment, if any, in the Contract Sum; (iv) the adjustment, if any, in the time of completion of the Contract and the construction schedule; and (v) an affidavit stating (a) the proposed substitution conforms to and meets all requirements of the pertinent Specifications and the requirements shown on the Drawings, and (b) the Contractor accepts the warranty and will coordinate the Work to be complete in all respects, as if originally specified by the Architect. Proposals for substitutions shall be submitted in writing to the Architect in sufficient time to allow the Architect no less than fifteen (15) working days for review. No substitutions will be considered or allowed without the Contractor's submittals of complete substantiating data and information.

§ 3.4.2.3 Whether or not the Architect accepts any proposed substitution, the Contractor shall reimburse the Owner for any fees charged by the Architect or other consultants for evaluating each proposed substitution.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them. THE CONTRACTOR RELEASES, INDEMNIFIES AND HOLDS HARMLESS THE OWNER FOR CONTRACTOR'S FORCES' NON-COMPLIANCE WITH OWNER'S DRUG-FREE, ALCOHOL-FREE, WEAPON-FREE, HARASSMENT-FREE, AND TOBACCO-FREE ZONES, CONTRACTOR'S FORCES' NON-COMPLIANCE WITH CRIMINAL LAW, OR CONTRACTOR'S OR CONTRACTOR'S FORCES' NON-COMPLIANCE WITH IMMIGRATION LAW OR REGULATIONS. Any individual found by Owner to have violated these restrictions is subject to permanent removal from the Project, at Owner's request. Contractor shall place similar language in its subcontract agreements, requiring its Subcontractors and Sub-subcontractors to be responsible for their own forces and Contractor shall cooperate with the Owner to ensure Subcontractor and Sub-subcontractor compliance.

§ 3.4.4 Including, but not limited to, the specific requirements of Article 10, Contractor, its subcontractors and vendors shall bear responsibility for compliance with all federal, state and local laws, regulations, guidelines, and ordinances pertaining to worker safety and applicable to the Work. Contractor further recognizes that the Owner and Architect do not owe the Contractor any duty to supervise or direct his work so as to protect the Contractor from the consequences of his own conduct.

§ 3.4.5 Pursuant to Texas Education Code Section 44.034, Contractor must give advance written notice to the Owner if the Contractor or an owner or operator of the Contractor has been convicted of a felony. The Owner may terminate this Agreement if the Owner determines that the Contractor failed to give such notice or misrepresented the conduct resulting in the conviction. This paragraph requiring advance notice does not apply to a publicly-held corporation.

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§ 3.4.6 CRIMINAL HISTORY CHECKS

§ 3.4.6.1 Contractor shall obtain all criminal history information required by Texas Education Code Chapter 22 regarding its "covered employees", as defined below. If Contractor is required by Chapter 22 to obtain the information from the Fingerprint-based Applicant Clearinghouse of Texas, then Contractor will also subscribe to that person's criminal history record information. Before beginning any Work on the Project, Contractor will provide written certification to the District that Contractor has complied with the statutory requirements as of that date. Upon request by Owner, Contractor will provide, in writing: updated certifications and the names and any other requested information regarding covered employees, so that the Owner may obtain criminal history record information on the covered employees. Contractor shall assume all expenses associated with obtaining criminal history record information.

§ 3.4.6.2 Contractor will not assign any "covered employee" with a "disqualifying criminal history", as those terms are defined below, to work on the Project. If Contractor receives information that a covered employee has a reported disqualifying criminal history, then Contractor will immediately remove the covered employee from the Project and notify the Owner in writing within three business days. If the Owner objects to the assignment of any covered employee on the basis of the covered employee's criminal history record information, then Contractor agrees to discontinue using that covered employee to provide services on Owner's Project. If Contractor has taken precautions or imposed conditions to ensure that the employees of Contractor and any subcontractor will not become covered employees, Contractor will ensure that these precautions or conditions continue throughout the time the contracted services are provided.

§ 3.4.6.3 For the purposes of this Section, "covered employees" means employees, agents or applicants of Contractor who has or will have continuing duties related to the services to be performed on Owner's Project and has or will have direct contact with Owner's students. The Owner will decide what constitutes direct contact with Owner's students. "Disqualifying criminal history" means: any conviction or other criminal history information designated by the Owner; any felony or misdemeanor conviction that would disqualify a person from obtaining educator certification under Texas Education Code Section 21.060 and 19 Texas Administrative Code §249.16; or one of the following offenses, if at the time of the offense, the victim was under 18 years of age or enrolled in a public school: a felony offense under Texas Penal Code Title 5 Offenses Against Persons; an offense for which a defendant is required to register as a sex offender under Texas Code of Criminal Procedure Chapter 62; or an equivalent offense under federal law or the laws of another state.

§3.4.6.4 Subcontractors or any subcontractor entity, as defined by Texas Education Code §22.08341(a)(3), shall be required by the terms of their contract with Contractor or any other contracting entity (as defined in Texas Education Code §22.08341(a)(1)), and by Texas law, to obtain the required criminal history record information on their employees, agents, or applicants, to give required certifications to Owner and the contracting entities, and to obtain required certifications from the subcontracting entity's subcontractors.

§3.4.6.5 On request of Owner, Contractor shall provide all necessary identifying information to allow Owner to obtain criminal history record information for covered employees of the Contractor and all subcontractors. Contractor shall update this list on Owner's request.

§ 3.4.7 OWNER'S ADDITIONAL REQUIREMENTS RELATED TO CRIMINAL HISTORIES

In addition, Contractor will at least annually obtain criminal history record information that relates to any employee, agent, or applicant of the Contractor, if the person has or will have duties related to the Project, and the duties are or will be performed on Owner's Project, or at another location where students are likely to be present. Contractor shall assume all expenses associated with the background checks and shall immediately remove any employee, agent or subcontractor who was convicted of a felony or a misdemeanor involving moral turpitude from Owner's property, or other location where students are likely to be present. Owner shall determine what constitutes "moral turpitude" or a "location where students are likely to be present."

§ 3.4.8 PREVAILING WAGE RATES

§ 3.4.8.1 Contractor, Contractor's Subcontractors and Sub-subcontractors shall pay all workers not less than the general prevailing rate of per diem wages for work of a similar character where the Project is located, as detailed in the "Minimum Wage Schedule" attached to this Agreement. Wages listed are minimum rates only. However, no claims for additional compensation above the Contract Sum shall be considered by the Owner because of payments of wage rates in excess of the applicable rate provided herein. Texas Government Code Section 2258.001 et seq.

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§ 3.4.8.2 Contractor shall forfeit, as a penalty to the Owner, $60 for each laborer, worker or mechanic employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the Contract Documents.

§ 3.4.8.3 Owner reserves the right to receive and review payroll records, payment records, and earning statements of employees of Contractor, and of Contractor's Subcontractors and Sub-subcontractors.

§ 3.4.8.4 In executing the Work under the Contract Documents, Contractor shall comply with all applicable state and federal laws, including but not limited to, laws concerned with labor, equal employment opportunity, safety and minimum wages.

§ 3.4.8.5 If no schedule is attached, then the parties shall use the wage rate determined by the US Department of Labor in accordance with the Davis-Bacon Act, 40 USC Section 276a, which can be accessed on the internet at www.gpo.gov/davisbacon/.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. The Contractor further warrants that Contractor shall perform the Work in a good and workmanlike manner, continuously and diligently in accordance with generally accepted standards of construction practice for construction of projects similar to the Project, except to the extent the Contract Documents expressly specify a higher degree of finish or workmanship, in which case the standard shall be the higher standard. All material shall be installed in a true and straight alignment, level and plumb; patterns shall be uniform; and jointing of materials shall be flush and level, unless otherwise directed in writing by the Architect. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance (unless such maintenance is Contractor's responsibility), , improper operation, or normal wear and tear and normal usage, but such exclusions shall only apply after Owner has taken occupancy of the damaged or defective portion of the Project. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Notwithstanding anything in the Contract Documents to the contrary, Owner and Contractor expressly agree that the warranties stated herein shall mean the individual warranties associated with each particular Work within the Project, and each such individual warranty shall run from the applicable Work's Final Completion date (unless otherwise expressly provided in the applicable Contract Documents for that particular Work). Contractor's express warranty is in addition to, and not in lieu of, Owner's other available remedies. All required warranties on equipment, machinery, materials, or components shall be submitted to the Architect on the manufacturer's or supplier's approved forms for delivery to the Owner. The warranties set out in this Subparagraph are not exclusive of any other warranties or guarantees set out in other places in the Contract Documents or expressed or implied under applicable law.

§ 3.5.2 ~~All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.~~ Contractor shall certify that the Project has been constructed in general conformance with the Architect's or Engineer's plans, specifications, and Construction Documents, as modified from time to time pursuant to the terms of the Contract Documents. Contractor shall fully complete a "Certification of Project Completion" as required by 19 Texas Administrative Code Section 61.1036.

§ 3.5.3 In the event of failure of materials, products, or workmanship, either during construction or the warranty period, the Contractor shall take appropriate measures to ensure correction of defective Work or replacement of the defective items, without cost to the Owner. Such warranty shall be maintained notwithstanding that certain systems may be activated prior to Substantial Completion as required for the satisfactory completion of the Project. Upon written notice from the Owner or Architect, the Contractor shall promptly remedy defects as covered by Contractor's warranty. If Contractor does not respond to the written notice, either by beginning corrective work or notifying Owner in writing regarding when corrective work will begin, within ten days of Contractor's receipt of the written notice, then the Owner may take measures to correct the Work and Contractor will be obligated to

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reimburse Owner's costs. The provisions of this subparagraph shall be in addition to, and not in lieu of, any other rights and remedies available to the Owner.

§ 3.5.4 When deemed necessary by the Owner and prior to installation of any item specifically made subject to a performance standard or regulatory agency standard under any provision of the Contract Documents, Contractor shall furnish proof of conformance to the Architect. Proof of conformance shall be in the form of:

.1 an affidavit from the manufacturer certifying that the item is in conformance with the applicable standards; or

.2 an affidavit from a testing laboratory certifying that the product has been tested within the past year and is in conformance with the applicable standards; or

.3 such further reasonable proof as is required by the Architect.

§ 3.5.5 The Contractor agrees to issue in the name of the owner, or assign to the Owner at Final Completion of the Work, such assignment to be effective no later than Final Completion, any and all material, equipment, fixtures and furniture (if supplied or installed by Contractor or its subcontractors), other special warranties, and manufacturers' warranties relating to materials and labor used in the Work. Contractor further agrees to perform the Work in such manner so as to preserve any and all manufacturers' warranties. All forms will be required to be submitted prior to Final Payment.

§ 3.5.6 The warranties of Contractor provided in Subparagraphs 3.5.1, 3.5.2, and 3.5.3 shall in no way limit or abridge the warranties of the suppliers of equipment and systems which are to comprise a portion of the Work and all such warranties shall be in form and substance as required by the Contract Documents. Contractor shall take no action or fail to act in any way which results in the termination or expiration of such third party warranties or which otherwise results in prejudice to the rights of Owner under such warranties. Contractor agrees to provide all notices required for the effectiveness of such warranties and shall include provisions in the contracts with the providers and manufacturers of such systems and equipment whereby Owner shall have a direct right, but not a duty, of enforcement of such warranty obligations.

§ 3.5.7 Contractor shall maintain a complete and accurate schedule of the date(s) of Substantial Completion, the date(s) of Final Completion, and the dates upon which the warranty under Section 12.2 herein on each phase or building will expire. Contractor shall provide a copy of such schedules to Owner and Architect. Prior to termination of the warranty period under Section 12.2 herein, Contractor shall accompany Owner and Architect on re-inspection of each Work in the Project and Contractor shall be responsible for correcting any warranty items which are observed or reported during the warranty period under Section 12.2 herein. Contractor shall prosecute such warranty work under Section 12.2 herein without interruption until accepted by Owner and Architect, even though such work should extend beyond the warranty period under Section 12.2 herein. If Contractor fails to provide the schedules to Owner and Architect, Contractor's warranty obligation described herein shall continue until such inspection is conducted and deficiencies are corrected.

§ 3.5.8 Prior to receipt of Final Payment, Contractor shall:

.1 Obtain duplicate original warranties, executed by all subcontractors, making the dates of beginning of the warranties the Date of Final Completion; and the warranties of suppliers and manufacturers, making the dates of beginning of the warranties no later than the Date of Final Completion;

.2 Verify that the documents are in proper form and contain full information;

.3 Co-sign warranties when required;

.4 Bind all warranties in commercial quality 8-1/2 X 11 inch three-ring binder, with hardback, cleanable, plastic covers;

.5 Label the cover of each binder with a typed or printed title labeled "WARRANTIES", along with the title of the Project; name, address and telephone number of Contractor; and name of its responsible principal;

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.6 Include a Table of Contents, with each item identified by the number and title of the specification section under which the product is specified; and

.7 Separate each warranty with index tab sheets keyed to the Table of Contents listing.

.8 Deliver warranties and bonds in the form described above, to the Architect who will review same prior to submission to the Owner.

§ 3.6 Taxes

~~The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.~~ Owner is an exempt entity under the tax laws of the State of Texas. Texas Tax Code §151.309; 34 TAC §3.322. The Owner represents that this Project is eligible for exemption from the State Sales Tax on tangible personal property and material incorporated in the Project, provided that the Contractor fulfills the requirements of the Texas Tax Code §151.309, §151.310, §151.311 and 34 TAC §3.291; 3.287. For the purpose of establishing exemption, it is understood and agreed that the Contractor may be required to segregate materials and labor costs at the time a Contract is awarded. Contractor will accept a Certificate of Exemption from the Owner, pursuant to Texas Tax Code §151.054(e); §151.155; and 34 TAC §3.287. Contractor shall obtain Certificates of Resale from Contractor's suppliers. Texas Tax Code §151.154, 34 TAC §3.285. Failure of Contractor or any Sub-Contractor to obtain Certificates of Resale from their suppliers shall make the Contractor or Sub-Contractor responsible for absorbing the tax, without compensation from Owner. Contractor shall pay all necessary local, county and state taxes, income tax, compensation tax, social security and withholding payments as required by law. CONTRACTOR HEREBY RELEASES, INDEMNIFIES, AND HOLDS HARMLESS OWNER FROM ANY AND ALL CLAIMS AND DEMANDS MADE AS A RESULT OF THE FAILURE OF CONTRACTOR OR ANY SUBCONTRACTOR TO COMPLY WITH THE PROVISIONS OF ANY OR ALL SUCH LAWS AND REGULATIONS.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 ~~Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.~~ After Architect has filed the plans and specifications with the Texas Department of Licensing and Regulation, Architect shall notify Contractor that Contractor may make and submit the applications for the building permit. The Owner shall pay the municipality directly for the building permit and all other development "impact" fees, if any. The Contractor shall continue to be responsible for payment of other permits, governmental fees, licenses, and inspections necessary for proper execution of the Contract and which are legally required when bids or proposals are received. Such fees and expenses shall only be reimbursable to Contractor if expressly agreed to herein.

§ 3.7.1.1 The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar connection charges.

§ 3.7.1.2 The Contractor shall pay directly all temporary utility charges, tap charges, and water meter charges, without reimbursement from Owner. After consultation with the Owner, the Contractor shall also obtain all permits and approvals, and pay all fees and expenses, if any, associated with National Pollutant Discharge Elimination System (NPDES) regulations administered by the Environmental Protection Agency (EPA) and local authorities, if applicable, that require completion of documentation and/or acquisition of a "Land Disturbing Activities Permit" for the Project. Also after consultation with the Owner, the Contractor shall obtain all permits and approvals, and pay all fees and expenses, if any, associated with Storm Water Pollution Prevention and Pollution Control Plan (SWPPP) regulations administered by the Texas Commission on Environmental Quality (TCEQ) and local authorities. Contractor's obligations under this Section may or may not require it to obtain or perform engineering services during the pre-construction phase to prepare proper drainage for the construction sites. Any drainage alterations made by Contractor during the construction process, which require the issuance of a permit, shall be at Contractor's sole cost. Reimbursable expenses shall not include any fines or penalties assessed against the Contractor, Contractor's subcontractors, the Project, or the Owner.

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§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. . In addition, Contractor shall authorize posting of any notices concerning the Workers Compensation insurance carried by other parties involved in the Project, including without limitation, Architect, at the same location where Contractor posts notices regarding Workers Compensation. If applicable, the Contractor shall procure and obtain all bonds required of the Owner or the Contractor by the municipality in which the Project is located or by any other public or private body with jurisdiction over the Project. In connection with such bonds, the Contractor shall prepare all applications, supply all necessary back-up material and furnish the surety with any required personal undertakings. The Contractor shall also obtain and pay all charges for all approvals for street closings, traffic control, parking meter removal and other similar matters as may be necessary or appropriate from time to time for the performance of the Work.

§ 3.7.3 If the Contractor performs Work ~~knowing~~ when Contractor knows or reasonably should have known it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, the Contract Documents, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than three (3) business~~14~~ days after first observance of the conditions. Contractor agrees that this is a reasonable notice requirement. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially, ~~and~~ report findings and a recommended resolution in writing to Owner and Contractor. If Owner's Board of Trustees and Contractor cannot agree on an equitable adjustment to the Contract Sum or Contract time, then either party may pursue alternative dispute resolution as provided for in Article 15 within ninety (90) days of the Architect's recommendation.. If such conditions will cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, the Architect will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. ~~If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.~~

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect in writing. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.7.6 The Contractor shall be responsible for timely notification to and coordination with all utility companies regarding the provision of services to the Project. The Contractor shall inform the Architect at once when the Owner's participation is required, and the Architect shall immediately notify the Owner. Connections for temporary and permanent utilities and payment for temporary utilities services required for the Work, whether the Work is new construction or renovation of an existing facility, are the responsibility of the Contractor unless otherwise agreed. If the Work is new construction, then payment for temporary and/or permanent utility services shall be the responsibility of the Contractor until Substantial Completion.

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§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection, unless required to do so by the terms of the Construction Documents.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site ~~and all required taxes~~, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum , unless required to do so by the terms of the Construction Documents, shall be adjusted accordingly ~~by Change Order~~. The amount of the adjustment ~~Change Order~~ shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.8.4 When performing Work under allowances, Contractor shall solicit and receive not less than three written proposals and shall provide the Work as directed by the Architect, upon Owner's written approval, on the basis of the best value to the District.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work. In addition, the Contractor may employ a project manager and necessary assistants who may supervise several Project sites. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be similarly confirmed in writing. Other communications shall be similarly confirmed on written request in each case. Questions about plan interpretation or directions shall be submitted to the Architect in the form of a written request for information and the Architect shall respond to such request for information in a reasonable and timely fashion. Contractor's selection of project manager or superintendent(s) shall be approved by Owner, and Contractor shall not replace the project manager or superintendent(s) without Owner's consent or until a replacement project manager or superintendent(s) has been selected in accordance with this Section. The Owner may reject or require removal of any job superintendent, project manager or employee of the Contractor, Subcontractor or Sub-Subcontractor involved in the Project. Contractor shall provide an adequate staff for the proper coordination and expedition of the Work. Owner reserves the right to require Contractor to dismiss from the Work any employee or employees that Owner may deem incompetent, careless, insubordinate, or in violation of any provision in these Contract Documents. This provision is applicable to Subcontractors, Sub-Subcontractors and their employees.

§ 3.9.2 ~~The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.~~

§ 3.9.3 ~~The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.~~ Contractor's superintendent shall be present full-time on the site as soon as possible after commencement of the Work, and shall remain assigned to this Work, and present on the site during performance of the Work, throughout the course of the Work until items requiring completion or correction, identified at Substantial Completion pursuant to Section 9.8, have been completed or corrected. From Substantial Completion until Final Completion, the superintendent shall be on the site as necessary to ensure that Final Completion occurs within 30 days of Substantial Completion.

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§ 3.9.4 Owner shall be notified not less than 24 hours before any time that superintendent will not be present at the site for any reason except periodic illness. If the reason is due to illness, then Owner shall be notified at the beginning of that day. Owner shall be notified of the identity of the acting superintendent. In the event the superintendent is absent from the site and notice has not been provided nor has an acting superintendent been assigned to the Work, then an amount equal to the superintendent's daily rate shall be deducted from the amount owed to the Contractor under general conditions for such day.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. The schedule shall not interfere with the operation of Owner's existing facilities and operations without Owner's prior written approval.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall prepare and submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in ~~general~~ accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The Contractor shall hold weekly progress meetings at the Project Site, or at such other time and frequency as are acceptable to the Owner. Progress of the work shall be reported at said meetings with reference to Contractor's construction schedule. The Contractor shall submit to the Architect with each monthly application for payment a copy of the progress schedule showing all modifications required, and shall take whatever corrective action is necessary to assure that the project completion schedule is met at no additional cost to Owner, except as allowed herein. In the event that Contractor shall fall behind schedule at any time, Contractor shall develop and deliver a recovery plan to the Owner with a recovery schedule and a program describing the additional manpower, overtime, material expediting, resequencing of the Work and other steps Contractor shall take to meet the requirements of the Contract. Contractor shall not be entitled to compensation from the Owner or any increase in the Contract Sum for the schedule recovery efforts. No approval or consent by the Owner of any plan for resequencing or acceleration of the Work submitted by Contractor shall constitute a waiver by Owner of any damages or losses which Owner may suffer by reason of such resequencing or the failure of Contractor to meet the Substantial Completion Date or the Final Completion Date.

§ 3.11 Documents and Samples at the Site

The Contractor shall maintain and make available at all times, at the Project site, the ~~Contract~~ Construction Documents, including Change Orders, Construction Change Directives, field test records (including environmental inspection and test records), inspection certificates or records, manufacturers' certificates, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner at all times, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.2 In addition to any other requirement in the Contract Documents and prior to installation, Contractor shall furnish or cause a subcontractor to furnish, for the Owner's and Architect's written approval, a physical sample of each specified item, product, fixture, or device which is visible by the general public and/or attached to an architecturally-finished surface. Samples shall be suitably labeled, adequately protected, and properly stored at the site. Samples which are approved and undamaged will be considered to be suitable for incorporation into the Work.

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§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the ~~information given and the design concept expressed in the~~ Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. Specific dimensions, quantities, installation and performance of equipment and systems in compliance with the Construction Documents and the Contract Documents remain the Contractor's responsibility.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. ~~The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents.~~ The

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Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, completeness, and accuracy of the services, certifications, and approvals performed or provided by such design professionals., ~~provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy.~~ Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. A registered architect must prepare plans and specifications for all the Work, as governed by the Texas Occupations Code Chapter 1051; and a registered engineer must prepare plans, specifications and estimates for all Work governed by Texas Occupations Code Chapter 1001. In the event that Contractor retains a licensed design professional under the terms of this paragraph, Contractor shall require that the licensed design professional carry commercial general liability and errors and omissions insurance coverage in the same amounts and forms as required of the Architect on this Project. In the event that the licensed design professional retained by the Contractor will be conducting on-site services or observations, the licensed design professional shall also carry worker's compensation insurance and comprehensive automobile liability in the same amounts and forms as required of the Architect on this Project.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Contractor shall submit complete drawings, data and samples to the Architect at least fifteen (15) days prior to the date the Contractor needs the reviewed submittals and samples returned. The Contractor shall be prepared to submit color samples on any key items (such as quarry tile, vinyl wall covering, etc.) within fifteen (15) days of the award of Subcontract(s). All color samples required for the Work shall be received within sixty (60) days of the date of the approval of the Contract Sum if the Project is an A101 project, or Guaranteed Maximum Price if the Project is an A133 project. Once samples of all key items are received, the Architect will finalize color selections.

§ 3.12.12 The Contractor shall submit the number of copies of product data and samples which the Contractor and subcontractors need for their use, plus two additional sets for the Architect, one additional set for the Owner and one additional set for each of the Architect's consultants involved with the particular section of Work. Where shop drawings are involved, the Contractor shall submit one high quality reproducible transparency and one opaque print of the shop drawing for the Architect, plus one additional opaque print for each of the Architect's consultants involved with the particular section of Work. The reproducible transparency will be marked by the Architect and/or his consultants. After final review and correction of the submittal, the Contractor shall send one corrected set to the Architect and each of the Architect's consultants involved with the particular section of Work.

§ 3.12.13 The Architect's review of Contractor's submittals shall be limited to examination of an initial submittal and one (1) re-submittal. The Architect's review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall be entitled to reimbursement from the Contractor of amounts paid to the Architect for evaluation of such additional re-submittals.

§ 3.12.14 The Contractor represents and warrants that all shop drawings shall be prepared by persons and entities possessing expertise and experience in the trade for which the shop drawings are prepared and, if required by the Architect or applicable law, by a licensed engineer.

§ 3.13 Use of Site

§3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 Only materials and equipment which are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed

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from the Project site. Protection of construction material and equipment stored at the Project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

§ 3.13.3 The Contractor and its subcontractors shall not erect any sign on the Project site without the prior written consent of the Owner.

§ 3.13.4 Contractor shall ensure that the Work, at all times, is performed in a manner that affords Owner reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed in such a manner that public areas adjacent to the Site of the Work shall be free from all debris, building material and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Construction Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of any area or building adjacent to the site of the Work, or the building, in the event of partial occupancy.

§ 3.13.5 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrance and parking areas other than those designated by the Owner. The Contractor shall comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly, provided, however, that any such cutting, fitting or patching can only be performed if the cutting, fitting or patching results in Work that is in accordance with the Construction Documents and Contract Documents. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.14.3 No cutting of structural elements will be permitted unless specifically approved in writing by Architect. Fitting and patching shall only be done with new products, and shall only performed by those skilled in performing the original Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall, on a daily basis, keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. Contractor shall provide on-site containers for the collection of waste materials, debris and rubbish, and shall periodically remove waste materials, debris and rubbish from the Work and dispose of all such materials at legal disposal areas away from the site. All cleaning operations shall be scheduled so as to ensure that contaminants resulting from the cleaning process will not fall on newly-coated or newly-painted surfaces. Immediately after unpacking materials, all packing case lumber or other packing materials, wrapping or other like flammable waste shall be collected and removed from the building and premises. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project. Care shall be taken by all workers not to mark, soil, or otherwise deface any finish. In the event that any finish becomes defaced in any way by mechanics or workers, the Contractor or any of his Subcontractors shall clean and restore such surfaces to their original condition.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 The Contractor shall be responsible for the protection of the Work. Prior to the Architect's inspection for Substantial Completion, the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, putty, soil, paint and foreign substances from all surfaces, including glass and painted surfaces; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in

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mechanical equipment; clean roofs, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site; clean and polish all floors; clean and polish all hardware; and repair all Work damaged during cleaning.

§ 3.15.4 After construction is complete, Contractor shall: (1) employ skilled workers for final cleaning; (2) remove grease, mastic adhesive, dust, dirt, stains, fingerprints, labels and other foreign materials from all sight-exposed interior and exterior surfaces; (3) wash and shine glazing and mirrors; (4) polish glossy surfaces to a clear shine; (5) vacuum clean carpeted and similar soft surfaces; (6) clean (damp mop with clean mop and water) resilient and hard surface floors repeating as necessary until no visible residue remains on floors; (7) clean plumbing fixtures to a sanitary condition; (8) clean surfaces of all equipment and remove excess lubrication; (9) clean permanent filters and replace disposable filters in ventilating systems if units were operated during construction and clean ducts, blowers and coils; (10) clean light fixtures; (11) remove waste, foreign matter and debris from roofs, gutters, area ways and drainage ways; (12) remove waste, debris and surplus materials from the site; (13) remove stains, spills and foreign substances from paved areas; and (14) broom clean exterior concrete and paved surfaces and rake clean the grounds.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect and their designated representatives with access to the Work in preparation and progress wherever located. The presence of the Owner, Architect or their representatives does not constitute acceptance or approval of the Work.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. THE CONTRACTOR SHALL DEFEND SUITS OR CLAIMS FOR INFRINGEMENT OF COPYRIGHTS AND PATENT RIGHTS, SHALL WAIVE AND RELEASE CLAIMS AGAINST THE OWNER AND ARCHITECT, AND SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER AND ARCHITECT FROM LOSS ON ACCOUNT THEREOF, PROVIDED, HOWEVER, CONTRACTOR SHALL NOT BE RESPONSIBLE TO ARCHITECT FOR SUCH DEFENSE OR LOSS WHEN A PARTICULAR DESIGN, PROCESS OR PRODUCT OF A PARTICULAR MANUFACTURER OR MANUFACTURERS IS REQUIRED BY THE CONTRACT DOCUMENTS, OR WHERE THE COPYRIGHT VIOLATIONS ARE CONTAINED IN DRAWINGS, SPECIFICATIONS OR OTHER DOCUMENTS PREPARED BY THE ARCHITECT, AND SHALL NOT BE RESPONSIBLE TO OWNER IF OWNER REQUIRES A PARTICULAR DESIGN, PROCESS OR PRODUCT THAT CONSTITUTES A COPYRIGHT VIOLATION. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Owner and Architect in writing. ~~The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.~~

§ 3.18 Indemnification

§ 3.18.1 ~~To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.~~ TO THE FULLEST EXTENT PERMITTED BY LAW, THE CONTRACTOR SHALL WAIVE AND RELEASE CLAIMS AGAINST AND SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER, ARCHITECT, OWNER'S TRUSTEES, ARCHITECT'S CONSULTANTS, OWNER'S CONSULTANTS AND OFFICERS, AGENTS AND EMPLOYEES OF ANY OF THEM, FROM AND AGAINST CLAIMS, DAMAGES, LOSSES, CAUSES OF ACTION, SUITS, JUDGMENTS AND EXPENSES, INCLUDING BUT NOT LIMITED TO ATTORNEYS' FEES, ARISING OUT OF OR RESULTING FROM PERFORMANCE OF THE WORK,

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PROVIDED THAT SUCH CLAIM, DAMAGE, LOSS OR EXPENSE IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH, OR TO INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY (INCLUDING THE WORK ITSELF) INCLUDING LOSS OF USE RESULTING THEREFROM, BUT ONLY TO THE EXTENT CAUSED IN WHOLE OR IN PART BY WILLFUL OR NEGLIGENT ACTS OR OMISSIONS OF THE CONTRACTOR, A SUB-CONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THEM, ANYONE THEY CONTROL OR EXERCISE CONTROL OVER, OR ANYONE FOR WHOSE ACTS THEY MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT SUCH CLAIM, DAMAGE, LOSS OR EXPENSE IS CAUSED IN PART BY ANY WILLFUL OR NEGLIGENT ACTS OR OMISSIONS OF OWNER OR OWNER'S CONSULTANTS OR OTHER INDEMNIFIED PARTIES. SUCH OBLIGATION SHALL NOT BE CONSTRUED TO NEGATE, ABRIDGE, OR REDUCE OTHER RIGHTS OR OBLIGATIONS OF INDEMNITY THAT WOULD OTHERWISE EXIST AS TO A PARTY OR PERSON DESCRIBED IN THIS SECTION 3.18. ALL COSTS AND EXPENSES SO INCURRED BY ANY OF THE INDEMNIFIED PARTIES IN THAT EVENT SHALL BE REIMBURSED BY CONTRACTOR TO THE INDEMNIFIED PARTIES, AND ANY COST AND EXPENSES SO INCURRED BY INDEMNIFIED PARTIES SHALL BEAR INTEREST UNTIL REIMBURSED BY CONTRACTOR, AT THE RATE OF INTEREST PROVIDED TO BE PAID BY THE JUDGMENT UNDER THE LAWS OF THE STATE OF TEXAS.

§ 3.18.2 IN CLAIMS AGAINST ANY PERSON OR ENTITY INDEMNIFIED UNDER THIS SECTION 3.18 BY AN EMPLOYEE OF THE CONTRACTOR, A SUBCONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THEM, OR ANYONE FOR WHOSE ACTS THEY MAY BE LIABLE, THE INDEMNIFICATION OBLIGATION UNDER SECTION 3.18.1 SHALL NOT BE LIMITED BY A LIMITATION ON AMOUNT OR TYPE OF DAMAGES, COMPENSATION, OR BENEFITS PAYABLE BY OR FOR THE CONTRACTOR OR A SUBCONTRACTOR UNDER INSURANCE POLICIES, WORKERS' COMPENSATION ACTS, DISABILITY BENEFIT ACTS, OR OTHER EMPLOYEE BENEFIT ACTS.

§ 3.18.3 THE OBLIGATIONS OF THE CONTRACTOR UNDER THIS SECTION 3.18 SHALL NOT EXTEND TO THE LIABILITY OF THE ARCHITECT, THE ARCHITECT'S CONSULTANTS, AND AGENTS AND EMPLOYEES OF ANY OF THEM, CAUSED BY OR RESULTING FROM: (1) DEFECTS IN PLANS, DESIGNS, OR SPECIFICATIONS PREPARED, APPROVED, OR USED BY THE ARCHITECT OR ENGINEER; OR (2) NEGLIGENCE OF THE ARCHITECT OR ENGINEER IN THE RENDITION OR CONDUCT OF PROFESSIONAL DUTIES CALLED FOR OR ARISING OUT OF THE CONSTRUCTION CONTRACT AND THE PLANS, DESIGNS, OR SPECIFICATIONS THAT ARE A PART OF THE CONSTRUCTION CONTRACT; AND (3) ARISING FROM : (A) PERSONAL INJURY OR DEATH; (B) PROPERTY DAMAGE; OR (C) ANY OTHER EXPENSE THAT ARISES FROM PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE, OR AS OTHERWISE LIMITED BY TEXAS CIVIL PRACTICE & REMEDIES CODE SECTION 130.001 ET SEQ.

§ 3.18.4 THE OWNER MAY CAUSE ANY OTHER CONTRACTOR WHO MAY HAVE A CONTRACT WITH THE OWNER TO PERFORM CONSTRUCTION OR INSTALLATION WORK IN THE AREAS WHERE WORK WILL BE PERFORMED UNDER THIS AGREEMENT, TO AGREE TO INDEMNIFY AND TO HOLD THE OWNER AND THE CONTRACTOR HARMLESS FROM ALL CLAIMS FOR BODILY INJURY AND PROPERTY DAMAGE TO THE SAME EXTENT AS IS PROVIDED IN SECTION 3.18.1 ABOVE. LIKEWISE, CONTRACTOR AGREES TO INDEMNIFY AND TO HOLD THE OWNER'S OTHER CONTRACTORS HARMLESS FROM ALL CLAIMS FOR BODILY INJURY AND PROPERTY DAMAGE TO THE SAME EXTENT AS PROVIDED IN SECTION 3.18.1 ABOVE.

§ 3.18.5 THE PROVISIONS OF SECTION 3.18 IN ITS ENTIRETY SHALL SURVIVE THE COMPLETION, TERMINATION OR EXPIRATION OF THIS CONTRACT.

§ 3.18.6 It is agreed with respect to any legal limitations now or hereafter in effect and affecting the validity or enforceability of the indemnification obligations under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligations shall continue in full force and effect.

§ 3.18.7 It is understood and agreed that Subparagraph 3.18.1 above is subject to, and expressly limited by, the terms and conditions of Texas Civ. Prac. & Rem. Code Ann. Sec. 130.001 to 130.005, as amended.

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§ 3.18.8 THE OWNER MAY CAUSE ANY OTHER CONTRACTOR WHO MAY HAVE A CONTRACT WITH THE OWNER TO PERFORM CONSTRUCTION OR INSTALLATION WORK IN THE AREAS WHERE WORK WILL BE PERFORMED UNDER THIS AGREEMENT, TO AGREE TO INDEMNIFY AND TO HOLD THE OWNER AND THE CONTRACTOR HARMLESS FROM ALL CLAIMS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OR TO INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY {INCLUDING THE WORK ITSELF) INCLUDING LOSS OF USE, TO THE SAME EXTENT AS PROVIDED IN SUBPARAGRAPH 3.18.1 ABOVE.

§ 3.19 ANTITRUST VIOLATION. To permit the Owner to recover damages suffered in antitrust violations, Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which violate the antitrust laws of the United States, 15 U.S.C.A. Section 1 et seq. The Contractor shall include this provision in its agreements with each subcontractor and supplier. Each subcontractor shall include such provisions in agreements with sub-subcontractors and suppliers.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner~~, Contractor, and Architect. Consent shall not be unreasonably withheld.~~

§ 4.1.3 Except as expressly provided herein, the Contractor shall not be relieved of Contractor's obligation to perform the Work in strict accordance with the Construction Documents and the Contract Documents by the duties, responsibilities, or activities of the Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction, until ~~the date the Architect issues the~~ final payment is due, and, with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2.2. ~~Certificate for Payment.~~ The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, or as they may be amended in the future~~.~~

§ 4.2.2 ~~The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.~~ Architect shall visit the site at least twice per week (or more per week when deemed necessary by the Owner's Superintendent or when necessary to protect Owner's interests) and at other intervals appropriate to the stage of construction, to inspect the progress, quantity and quality of the work completed, to reject any observed nonconforming Work, and to determine if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Construction Documents and the Contract Documents and on time. Furthermore, a minimum of two job site meetings per month from commencement of construction through Final Completion will be initiated by the Architect and attended by the Contractor. Attendees will include the Owner, the Contractor's project manager and/or superintendent, Architect's project representative, and Architect. The Architect, Owner and their representatives shall at all times have access to the Work. Architect or its structural consultant will provide on-site observations prior to and during all concrete pours that contribute to the structural integrity of the building, including all pours of concrete piers, footings, grade beams, floor slabs, and concrete superstructure components, if applicable. In addition, Architect or its structural consultant will provide on-site observations prior to covering up or closing up of portions of the construction which, if covered, would conceal problems with the structural integrity of the Project. Contractor shall not close or cover said Work until said observations have occurred. Contractor or Architect will advise Owner of the need for any

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third-party laboratory or testing services to assist the Architect and Owner. On the basis of the on-site observations by Architect, Architect shall keep Owner and Contractor informed of the progress and quality of the Work, through Architect's field reports, and shall guard Owner against defects and deficiencies in the Work. Architect shall promptly notify Owner and Contractor orally regarding any defect or nonconforming Work, which shall be followed by notice in writing of defects or nonconforming Work noted and corrective actions taken or recommended. The Architect, however, shall not have control over or responsibility for the Contractor's construction means, methods, techniques, sequences, procedures, or safety programs, but this does not relieve Architect of Architect's responsibilities under this Agreement. Any services by Contractor made necessary by Contractor's construction defect or nonconforming Work shall be performed at no additional cost to Owner.

§ 4.2.3 ~~On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work.~~ The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect, or request of the Contractor.

§ 4.2.4 Communications

~~The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project.~~ Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. However, Owner reserves the right to communicate directly with the Contractor and Subcontractors. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. ~~The Contract Documents may specify other communication protocols.~~

§ 4.2.5 As further provided in the Contract Documents, b~~B~~ased on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect ~~has authority to~~ shall reject Work that does not conform to the Construction Documents and the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect ~~will have authority to require~~ will recommend to Owner additional inspection or testing of the Work in accordance with ~~Sections 13.4.2 and 13.4.3~~ the provisions of the Contract Documents, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Owner to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work. Architect and/or Contractor shall promptly notify, orally and in writing, the other party and Owner of any fault or defect in the Project or nonconformance with Construction Documents or the Contract Documents they may respectively discover and each, upon discovery of the defect or nonconformance, shall be responsible for notifying the other party and Owner of those corrective actions they respectively take; provided, however, Contractor shall have no duty to notify Owner of discoveries made or actions taken by Architect. Testing or inspections required by this subparagraph shall be conducted subject to the requirements of Chapter 2269 of the Texas Government Code.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Construction Documents and the Contract Documents. The Architect's action will be taken ~~in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with~~ such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or Separate Contractors, while allowing sufficient

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time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation ~~or performance~~ of equipment or systems, ~~all of which~~ remain the responsibility of the Contractor as required by the Construction Documents and the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. If any submittal does not comply with the requirements of the Construction Documents or the Contract Documents, then Architect shall require Contractor to come into compliance. The Architect shall promptly report in writing to the Contractor and Owner any errors, inconsistencies and omissions discovered by the Architect in the Shop Drawings, Product Data and Samples.

§ 4.2.8 ~~The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.~~ The Architect shall review, prepare and make recommendations to Owner regarding all Change Orders and Construction Change Directives for the Owner's approval and execution in accordance with the Construction Documents and the Contract Documents, accompanied by all supporting documentation. The Architect may authorize minor changes in the Work not involving an adjustment in Contract Sum or Guaranteed Maximum Price, or an extension of the Contract Time which are consistent with the intent of the Contract Documents. If necessary, the Architect shall prepare, reproduce and distribute Drawings and Specifications to describe Work to be added, deleted or modified, as provided in Section 7.4. The Architect shall accept requests by the Owner, and shall review properly prepared, timely requests by the Contractor for changes in the Work, including adjustments to the Contract Sum or Guaranteed Maximum Price, or Contract Time. A properly prepared request for a change in the Work by the Contractor shall be accompanied by sufficient supporting data and information to permit the Architect to make a reasonable determination without extensive investigation or preparation of additional drawings or specifications. If the Architect determines that requested changes in the Work are not materially different from the requirements of the Construction Documents or the Contract Documents, and do not change the Contract Sum or Guaranteed Maximum Price, or Contract Time, then the Architect may issue an order for a minor change in the Work with prior written notice to the Owner or recommend to the Owner that the requested change be denied. The Architect is not authorized to approve changes involving major systems such as: Heating, Ventilation and Air Conditioning ("HVAC"); roof; foundation; outward appearance; color schemes; floor plans; building materials; drainage or mechanical equipment without Owner's prior written consent.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and ~~decide matters~~ make recommendations concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations ~~and decisions~~ or recommendations of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and ~~decisions~~recommendations, the Architect will endeavor to secure faithful performance by both Owner and Contractor~~, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith~~.

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§ 4.2.13 The ~~Architect~~Owner's decisions on matters relating to aesthetic effect ~~will~~ shall be final ~~if consistent with the intent expressed in the Contract Documents~~.

§ 4.2.14 The Architect will review and respond to requests for information about the Construction Documents and the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information, at no additional cost to the Owner.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect in writing of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect ~~may~~ shall notify in writing the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection. All subcontractors shall be procured in accordance with Texas Education Code Chapter 44, Subchapter B, and Texas Government Code Chapter 2269, as applicable. A notice of no reasonable objection shall in no way relieve the Contractor from full responsibility for performance and completion of the Work and its obligations under the Contract Documents. The Contractor shall be fully responsible for the performance of its subcontractors, including those recommended or approved by the Owner.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. ~~If the proposed but rejected~~ When the parties agree on a proposed substitute Subcontractor ~~was reasonably capable of performing the Work~~, then the Contract Sum and Contract Time ~~shall~~ may be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.2.5 Each Contractor or subcontractor shall be required to completely familiarize itself with the plans and specifications, to visit the Work site to completely familiarize itself with existing conditions, and to conduct any other appropriate investigations, inspections or inquiries prior to submission of a bid or proposal. No increases in Contract Sums or Guaranteed Maximum Price shall be allowed for failure to so inspect or investigate.

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§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. The terms and conditions of the Contract Documents shall be incorporated by reference into each subcontract agreement, included as provided below. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. Each subcontractor shall provide proof of insurance to Contractor consistent with the Contractor's insurance to Owner and in an amount commensurate with the Work to be performed by the Subcontractor.

§ 5.3.2 Neither the Owner nor the Architect shall be obligated to pay or to insure the payment of any monies to subcontractors due to any non-payment to the Contractor or non-payment of subcontractors by the Contractor.

§ 5.3.3 The Contractor shall require any potential subcontractor to disclose to the Contractor any ownership interest or familial relationship between the Contractor, the Architect or the Owner and the potential subcontractor prior to entering into a subcontract. Contractor shall report to Owner all such disclosures and the Owner shall have the right, in its sole discretion, to reject any such affiliated subcontractor.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for any unperformed ~~a~~ portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause or convenience pursuant to ~~Section~~Article 14~~.2~~ or abandonment of the Project by the Contractor; and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights and obligations of the surety, if any, obligated under bond relating to the Contract~~.~~ ; and

.3 The Subcontractor provides bonds as required by law of prime contractors and by Owner.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 ~~Upon s~~Such assignment shall~~, if the Work has been suspended for more than 30 days, the Subcontractor's compensation be equitably adjusted for increases in cost resulting from the suspension.~~ not constitute a waiver by Owner of its rights against Contractor, including, but not limited to, claims for defaults, delays or defects for which a subcontractor or material vendor may also be liable.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. ~~If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.~~ Owner shall only be responsible for compensating subcontractors for Work performed or materials furnished from and after the date on which the Owner gives written notice of its acceptance of the subcontract agreement. Owner shall not be responsible for any Work performed or materials furnished by subcontractors prior to the date of Owner's written notice of acceptance.

§ 5.5 NOTICE OF SUBCONTRACTOR DEFAULT

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Contractor shall promptly notify Owner and Architect of any material defaults by any Subcontractor or Sub-subcontractor. Notwithstanding any provision contained in Article 5 to the contrary, it is hereby acknowledged and agreed that Owner has in no way agreed, expressly or implicitly, nor will Owner agree, to allow any Subcontractor, Sub-subcontractor or other materialman or worker employed by Contractor the right to obtain a personal judgment or to create a mechanic's or materialman's lien against Owner for the amount due from the Owner or the Contractor.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation. The Owner reserves the right to perform other non-Project-related construction work, maintenance and repair work, and school program operations at the site and near the site during the time period of the Work.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The ~~Owner~~ Contractor shall ~~provide for coordination of~~coordinate the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor to ensure that the Work remains on schedule~~, who shall cooperate with them~~. ~~The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules.~~ The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement between the Owner and Contractor. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 ~~Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.~~

§ 6.2 Contractor's~~mutual~~ Responsibility

§ 6.2.1 It shall be the responsibility of the Contractor to assist, review, and coordinate the scheduling of work performed by any of the Owner's Separate Contractors. In addition, the Contractor shall be responsible for coordinating and providing all construction administration necessary for the Work and the work of any of Owner's Separate Contractors. The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for site access and introduction and storage or staging of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents. Contractor shall be responsible for coordination between Contractor's subcontractors and Owner's Separate Contractors. Contractor shall review Owner's contract with Owner's Separate Contractors and become familiar with the requirements and scope of services contained therein.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify in writing the Architect and Owner of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work, and shall promptly report in writing to the Architect and Owner if Owner's Separate Contractors fail in any way to timely perform their services or negatively impact Contractor's schedule or ability to perform the Work . Failure of the Contractor to notify in writing the Architect and Owner of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate

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Contractor's completed or partially completed construction is fit and proper, and is performed in a timely manner, to receive the Contractor's Work. The Contractor shall not be responsible for latent discrepancies or defects in the construction or operations by the Owner or Separate Contractor ~~that are not apparent~~.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. ~~The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.~~

§ 6.2.3.1 If the Architect is required to provide additional services as provided in the Agreement between the Owner and the Architect, specifically relating to additional compensation for the Architect for evaluating an excessive number of claims submitted by the Contractor or others in connection with the Work in accordance with the Owner's Agreement with the Architect, then such services shall be paid for by the Contractor through the Owner, unless the additional services result from negligence of or an omission by the Architect.

§ 6.2.3.2 If the Architect provides services in connection with a legal proceeding, except when the Architect is a party thereto, and the Owner requests the Architect in writing to provide such services, then the cost of such services shall be paid for by the party whose act or omission was a proximate cause of the problem that led to the requirement to provide such services. Such services shall be paid for by such party through the Owner, who upon receipt of same shall reimburse the Architect.

§ 6.2.3.3 All construction costs resulting from the Contractor's negligence, lack of oversight, inattention to detail, failure to investigate, or failure to follow the Construction Documents or Contract Documents, will be borne by the Contractor.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the ~~Architect~~ Owner will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. A properly prepared written request for a change in the Work by Contractor shall be accompanied by sufficient supporting data and information to permit the Architect to make a recommendation to Owner.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents or Construction Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work. Contractor shall not make any claim for an adjustment to time, Contract Sum or Guaranteed Maximum Price due to: a change in the materials used; a change in the specified manner of constructing and/or installing the Work; or additional labor, services, or materials, beyond that actually required by the terms of the Construction Documents or the Contract Documents, unless made pursuant to a written order or directive from Owner authorizing Contractor to proceed with

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a change in the Work. No claim for an adjustment to time, Contract Sum or Guaranteed Maximum Price shall be valid unless so ordered or directed.

§ 7.1.4 The total Contractor mark-up for overhead, profit, or fee for work performed by the Contractor's own forces shall not exceed 10% of the cost of the change in the Work. The total Contractor mark-up for overhead, profit or fee for supervision of work performed by subcontractors' forces shall not exceed 4% of the cost of the change in the Work. The total subcontractor mark-up for overhead, profit or fee for work performed by the subcontractor's forces shall not exceed 10% of the cost of the change in the Work. In no event shall total mark-up for overhead, profit or fee in any work which involves a subcontractor or one or more sub-subcontractors, regardless of who performs the work, exceed 14% of the total cost of the change in the Work.

§ 7.1.5 Allowance balances may be used to fund changes in the Work. The Contractor will not be allowed an overhead, profit, or fee mark-up when changes in the Work are funded by one of the Allowances.

§ 7.1.6 If the Contract Sum is $1,000,000.00 or more, or if the Contract Sum is less than $1,000,000.00, and any Change Order, Construction Change Directives, or other Changes in the Work would increase the Contract Sum to $1,000,000.00 or more, the total of all Change Orders, Construction Change Directives, or other Changes in the Work may not increase the Contract Sum by more than 25% of the original Contract Sum. Any Change Order, Construction Change Directive, or other Change in the Work that would exceed that limit is void and of no effect. Texas Education Code §44.0411.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum or Guaranteed Maximum Price; and

.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum or Guaranteed Maximum Price may include those listed in Section 7.3.3.

§ 7.2.3 Contractor stipulates that acceptance of a Change Order by the Contractor constitutes full accord and satisfaction for any and all Claims, whether direct or indirect, arising from the subject matter of the Change Order.

§ 7.2.4 In no event shall a single change, or the aggregate of all changes, result in the total costs, reimbursements and fees exceeding the Contract Sum or the Guaranteed Maximum Price, unless agreed to in writing by Owner prior to the commencement of such modified or changed Work.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Guaranteed Maximum Price, or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum or Guaranteed Maximum Price and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum or Guaranteed Maximum Price, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon (additional mark-ups for overhead, profit, and fees will not be allowed);

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.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee, subject to the limitations of subparagraph 7.1.4; or

.4 As provided in Section 7.3.4, subject to the limitations of subparagraph 7.1.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum or Guaranteed Maximum Price, then Architect shall determine the adjustment on the basis of the amount by which the Contractor's direct costs have actually been increased over the direct cost of performing the Work without the Change in the Work. Direct costs shall be limited to the following: ~~reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:~~

.1 Actual ~~C~~costs of labor, including applicable payroll taxes, ~~fringe benefits required by agreement or custom~~, and workers' compensation insurance~~, and other employee costs approved by the Architect~~;

.2 Actual ~~C~~costs of materials, supplies, and equipment, including cost of transportation, used in performing the Change in the Work~~whether incorporated or consumed~~;

.3 Actual ~~R~~rental costs of machinery and equipment rented from third parties, exclusive of hand tools~~, whether rented from the Contractor or others~~;

.4 Actual ~~C~~costs of premiums for all bonds and insurance, and permit fees~~, and sales, use, or similar taxes,~~ directly related to the change; and

~~.5 Costs of supervision and field office personnel directly attributable to the change.~~

The Contractor shall keep and present, in such form as the Architect or Owner may prescribe, an itemized accounting of the items listed above, together with appropriate supporting documentation.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Guaranteed Maximum Price, or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum or Guaranteed Maximum Price, and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost plus the Contractor's allocated percent of profit and overhead, all as confirmed by the Architect. ~~When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.~~

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

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§ 7.4 Minor Changes in the Work

With prior written notice to the Owner's representative, ~~T~~the Architect may order minor changes in the Work that are consistent with the ~~intent of the~~ Contract Documents or Construction Documents and do not involve an adjustment in the Contract Sum or Guaranteed Maximum Price, or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Guaranteed Maximum Price, or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Guaranteed Maximum Price, or Contract Time, the Contractor waives any adjustment to the Contract Sum or Guaranteed Maximum Price, or extension of the Contract Time. The Contractor shall carry out such written orders promptly. Minor changes in the Work shall not include changes that involve the outward appearance of the structure, color schemes, floor plans, building materials, landscaping, or mechanical equipment.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for ~~Substantial~~ Final Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the ~~date established in the Agreement~~ first business day after Contractor's receipt of the written Notice to Proceed. The Notice to Proceed shall not be issued by Architect until the Agreement (or Amendment, if Contractor is a Construction Manager at Risk) has been signed by the Contractor, approved by Owner's Board of Trustees, signed by the Owner's authorized representative, and Owner and Architect have received, and approved as to form, all required payment and performance bonds and insurance, in compliance with Article 11. Issuance of the Notice to Proceed shall not relieve the Contractor of its responsibility to comply with Article 11.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8. The date of Final Completion is the date certified by the Architect in accordance with Paragraph 9.10. Unless otherwise agreed in writing by Owner, Contractor agrees that Final Completion shall occur not more than 30 days after the date of Substantial Completion.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor stipulates~~confirms~~ that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial and Final Completion within the Contract Time.

§ 8.2.4 The Contractor is subject to liquidated damages, as specified in the Agreement, if the Work is not completed by the date of Substantial Completion or the date of Final Completion.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by ~~labor disputes,~~ fire, governmental actions, ~~unusual delay in deliveries, unavoidable casualties,~~ or adverse weather conditions documented in accordance with Section 15.1.6.2, ~~or other causes beyond the Contractor's control~~; (4) by delay authorized in writing by the Owner ~~pending mediation and binding dispute resolution~~; or (5) by other causes that the Contractor asserts, and the Architect and Owner determine~~s~~, may justify delay, then the Contract Time ~~shall~~ may be extended for such reasonable time as the Architect and Owner may determine.

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§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 ~~This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.~~ This Agreement does not permit the recovery of damages, including, without limitation, extended home office overhead expenses, general conditions, or other consequential damages, by the Contractor for delay or disruption or for extensions of time due to bad weather or acts of God. Contractor agrees that the only possible compensation for any delay is an extension of time.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. In the event that the Project is a Construction Management at Risk Project, the Contract Sum shall not exceed the Guaranteed Maximum Price.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices may ~~shall~~ be equitably adjusted by prior written agreement.

§ 9.2 Schedule of Values

§ 9.2.1 Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum or, in the case of a Guaranteed Maximum Price, within 15 days after establishing the Guaranteed Maximum Price, to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment. The schedule of values shall be prepared in such a manner that each major item of work, whether done by Contractor's own forces or subcontracted, is shown as a single line item on AIA Documents G702 and G703, Application and Certificate for Payment and Continuation Sheet. If the Contractor is a Construction Manager at Risk, then the Contractor's fee and general conditions shall be specifically shown, and AIA Documents G702CMa and G703 shall be used.

§ 9.2.2 If the project is a Construction Manager at Risk project, in order to facilitate the review of Applications for Payment, the Schedule of Values shall be submitted on AIA Documents G702 and G703, and shall include the following:

.1 Contractor's cost for Contractor's fee (if applicable) bonds and insurance, mobilization, or general conditions, etc. shall be listed as individual line items.

.2 Contractor's costs for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, or paving, etc.

.3 On major subcontracts, such as mechanical, electrical and plumbing, the schedule shall indicate line items and amounts in detail (for example: underground, major equipment, fixtures, installation fixtures, or start-up, etc.).

.4 Costs for subcontract work shall be listed without any additional mark-up of Contractor's costs for overhead, profit, or supervision.

.5 If payment for stored materials is requested prior to installation, then material and labor shall be listed as separate line items.

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.6 Contractor shall provide a report of actual versus projected reimbursable expenses (general conditions), updated monthly.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect requires, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage ~~if provided for in the Contract Documents~~.

§ 9.3.1.1 ~~As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.~~ Contractor agrees that, for purposes of Texas Government Code Sections 2251.021 and 2251.042, receipt of the Application for Payment by the Architect shall not be construed as receipt of an invoice by the Owner. Contractor further agrees that Owner's receipt of the Certificate for Payment shall be construed as receipt of an invoice by the Owner, for purposes of Texas Government Code Sections 2251.021 and 2251.042.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor ~~does not intend to pay~~has not been invoiced by a Subcontractor or supplier, unless ~~such Work has been performed by others whom the Contractor intends to pay~~ Contractor has self-performed the Work.

§ 9.3.1.3 Until Final Completion of the Work, the Owner shall withhold retainage as provided in the Contract Documents, except that Owner shall not pay amounts for which the Architect refuses to certify payment, or the Owner refuses to pay, as provided herein in Section 9.4.3 or 9.5, as amended. The retainage shall be paid with the Final Payment. *(Note: if more than 5% is retained, under Texas law, then the retainage must be placed in an interest-bearing account, and the contractor must be paid the interest earned on the retainage upon completion of the Work. Texas Government Code Section 2252.032).*

§ 9.3.2 ~~Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.~~Payments will be made on the basis of invoices for specific materials or equipment incorporated in the Work and specific materials or equipment (1) suitably stored at the site or (2) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 The Contractor's Surety must agree, in writing, to the amounts included in each Application for Payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the off-site storage area and reviewing the stored contents. Contractor acknowledges that Architect's time may be an Additional Service and shall compensate Architect directly for same upon request.

.5 Payment shall not include any charges for overhead or profit on stored materials.

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.6 Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other documentation satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured and naming the specific materials or equipment stored and their location) and proof of delivery to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment until the materials or equipment are delivered to Owner's site or the agreed-upon off-site storage. Failure to follow these procedures shall result in nonpayment for storage of or insurance on stored materials and equipment. Failure to follow these procedures shall also result in nonpayment of materials and equipment until said materials and equipment are incorporated into the Work.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work. Neither Contractor nor any of its materialmen, laborers or Subcontractors shall have any lien rights against the Owner' s lands, building funds, materials or other property. No materialmen, laborers or Subcontractors of the Contractor shall have any enforceable rights against the Owner on this Contract. Materialmen. laborers and Subcontractors of the Contractor may have rights under any Payment Bond provided by the Contractor, but cannot look to the Owner for any help in enforcement of those rights. CONTRACTOR SHALL WAIVE, RELEASE, INDEMNIFY, AND HOLD OWNER HARMLESS FROM ANY LIENS, CLAIMS, SECURITY INTERESTS OR ENCUMBRANCES FILED BY THE CONTRACTOR, SUBCONTRACTORS, OR ANYONE CLAIMING BY, THROUGH, OR UNDER THE CONTRACTOR OR SUBCONTRACTOR FOR ITEMS COVERED BY PAYMENTS MADE BY THE OWNER TO CONTRACTOR.

§ 9.3.4 Contractor shall submit Applications for Payment in quadruplicate using AIA Documents G702 and G703 Application and Certificate of Payment (or G702CMa, if applicable) and Continuation Sheet. All blanks in the form must be completed and signatures of Contactor and Notary Public must be original on each form. Incomplete or inaccurate Applications for Payment shall be returned to the Contractor by the Architect for completion and/or correction. Owner shall have no responsibility for payment of same if the Application for Payment is incomplete or inaccurate.

§ 9.3.5 By signing each Application for Payment, the Contractor stipulates and certifies to the following: that the information presented is true, correct, accurate and complete; that the Contractor has made the necessary detailed examinations, audits, and arithmetic verifications; that the submitted Work has been completed to the extent represented in the Applications for Payment; that the materials and supplies identified in the Applications for Payment have been purchased, paid for, and received; that the subcontractors have been paid as identified in the Applications for Payment or that Contractor has been invoiced for same; that Contractor has made the necessary on-site inspections to confirm the accuracy of the Applications for Payment; that there are no known mechanics' or materialmens' liens outstanding at the date of the Application for Payment; that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current Payment Application; that, except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmens' liens on the Work; that the Payment Application includes only Work self-performed by Contractor or for which Contractor has been invoiced; and that releases from all Subcontractors and materialmen have been obtained in such form as to constitute an effective release of lien under the laws of the State of Texas covering all Work performed and for which payment has been made by the Owner to the Contractor. Contractor understands that documents submitted to Owner become government documents under the laws of the State of Texas. Contractor further understands that falsification of Contractor's Application for Payment may constitute a violation of the penal laws of the State of Texas, including, but not limited to, Texas Penal Code Sections 32.46, 37.09, and 37.10, and may justify termination of Contractor's Contract with Owner. Contractor further understands and agrees that falsification of documents may entitle Owner to restitution as permitted by Texas law and these Contract Documents.

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§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, carefully evaluate and review the Application for Payment and, when appropriate, return the Application for Payment to the Contractor as provided in Section 9.3.4. If the Application for Payment is complete, then the Architect shall sign and either: (1) certify and issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) certify and issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner in writing of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. Architect's written reasons for withholding certification shall be construed as the notice required by Texas Government Code Section 2251.042 et seq.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner~~,~~ ~~based on the Architect's evaluation of the Work and the data in the Application for Payment,~~ that the Architect has observed the progress of the Work and determined that, in the Architect's professional opinion~~, to the best of the Architect's knowledge, information, and belief,~~ the Work has progressed to the point indicated, and the quality of the Work is in accordance with the Contract Documents. Further, the issuance of the Certificate for Payment will constitute a representation by the Architect to the Owner that the Architect has~~,~~ carefully evaluated and certified that the amounts requested in the Application for Payment are valid and correct and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect in writing to the Owner. However, the issuance of a Certificate for Payment will not be a representation that the Architect has: (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data unless requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum. Examinations, audits, and verifications, if required by the Owner, will be performed by the Owner's accountants or other representatives of the Owner acting in the sole interest of the Owner.

§ 9.4.3 The issuance of a Certificate for Payment shall constitute a recommendation to the Owner regarding the amount to be paid. This recommendation is not binding on the Owner if Owner knows of other reasons under the Contract Documents why payment should be withheld.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; ~~or~~
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents; or

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.8 failure to submit a written plan indicating action by the Contractor to regain the time schedule for completion of Work within the Contract time.

§ 9.5.2 When ~~either party~~the Contractor disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, ~~that party~~the Contractor may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 ~~If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment~~ Notwithstanding any provision contained within this Article, if the Work has not attained Substantial Completion or Final Completion by the required dates, subject to extensions of time allowed under the Contract Documents, then Architect may withhold any further Certificate for Payment from Contractor to the extent necessary to preserve sufficient funds to complete the construction of the Project and to cover liquidated damages. The Owner shall not be deemed in default by reason of withholding payment as provided for in Sections 9.3.4, 9.4.3, 9.5.1, or this Section.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment ~~for undisputed~~ amounts in the manner and within the time provided in the Contract Documents~~,~~ and shall so notify the Architect. Owner shall notify Contractor within 21 days if Owner disputes the Architect's Certificate for Payment pursuant to Texas Government Code Section 2251.042 et seq., listing the specific reasons for nonpayment. Payments to the Contractor shall not be construed as releasing the Contractor or his Surety from any obligations under the Contract Documents.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner. In compliance with Texas Government Code Section 2251.022, the Contractor shall, within ten (10) days following receipt of payment from the Owner, pay all bills for labor and materials performed and furnished by others in connection with the Work, and shall, if requested, provide the Owner with evidence of such payment. Contractor shall include a provision in each of its subcontracts imposing the same payment obligations on its Subcontractors as are applicable to the Contractor hereunder, and if the Owner so requests, shall provide to the Owner copies of such Subcontractor payments. If the Contractor has failed to make payment promptly to the Contractor's Subcontractors or for materials or labor used in the Work for which the Owner has made payment to the Contractor, then the Owner shall be entitled to withhold payment to the Contractor in part or in whole to the extent necessary to protect the Owner. This Section is subject to the provisions of Texas Business and Commerce Code Chapter 56.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, ~~except as may otherwise be required by law~~. Any action taken by the Owner to require the Contractor to pay a Subcontractor shall not impose any liability on Owner to the Subcontractor or supplier.

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§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision. Payments received by the Contractor from the Owner for Work properly performed by Subcontractors, or materials properly provided by suppliers, shall be held in trust by the Contractor for the benefit of those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor. Texas Property Code §162.001.

§ 9.6.8 ~~Provided the Owner has fulfilled its payment obligations under the Contract Documents, t~~ THE CONTRACTOR SHALL DEFEND AND INDEMNIFY THE OWNER FROM ALL LOSS, LIABILITY, DAMAGE OR EXPENSE, INCLUDING REASONABLE ATTORNEY'S FEES AND LITIGATION EXPENSES, ARISING OUT OF ANY LIEN CLAIM OR OTHER CLAIM FOR PAYMENT BY ANY SUBCONTRACTOR OR SUPPLIER OF ANY TIER. UPON RECEIPT OF NOTICE OF A LIEN CLAIM OR OTHER CLAIM FOR PAYMENT, THE OWNER SHALL NOTIFY THE CONTRACTOR. IF APPROVED BY THE APPLICABLE COURT, WHEN REQUIRED, THE CONTRACTOR MAY SUBSTITUTE A SURETY BOND FOR THE PROPERTY AGAINST WHICH THE LIEN OR OTHER CLAIM FOR PAYMENT HAS BEEN ASSERTED.

§ 9.6.9 Contractor shall not withhold as a retainage a greater percentage from Subcontractors or materialmen than the percentage that Owner withheld as retainage from payments to Contractor.

§ 9.7 Failure of Payment

§ 9.7.1 ~~If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or~~ Pursuant to Texas Government Code Section 2251.051, if the Owner does not pay the Contractor any payment certified by the Architect, which is undisputed, due, and owing ~~within seven days~~ after the date the payment is due under the Contract Documents,~~established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution,~~ then the Contractor ~~may~~, upon ten (10) ~~seven~~ additional days' written notice to the Owner and Architect, that payment has not been made and the Contractor intends to suspend performance for nonpayment, may stop the Work until payment of the undisputed amount owing has been received. ~~The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.~~ If the Owner provides written notice to the Contractor that: 1) payment has been made; or 2) a bona fide dispute for payment exists, listing the specific reasons for nonpayment, then Contractor shall be liable for damages resulting from suspension of the Work. If a reason specified is that labor, services, or materials provided by the Contractor are not provided in compliance with the Contract Documents, then the Contractor shall be provided a reasonable opportunity to cure the noncompliance or to compensate Owner for any failure to cure the noncompliance. No amount shall be added to the Contract Sum as a result of a dispute between Owner and Contractor unless and until such dispute is resolved in Contractor's favor.

§ 9.7.2 If the Architect does not issue a Certificate for Payment within seven days after receipt of the Contractor's Application for Payment, through no fault of the Contractor, then the Contractor shall provide written notice to the Owner, and the Owner shall have fourteen (14) business days after receipt of such notice to provide or obtain a Certificate for Payment. If Owner fails to provide or obtain the Certificate for Payment, then the Contractor may, upon fourteen (14) additional business days' written notice to the Owner and Architect, stop the Work until payment of the undisputed amount owing has been received.

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§ 9.7.3 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, then such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due to Owner, pursuant to the Contract, or if the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, then the Owner shall have an absolute right to offset such amount against the Contract Sum and, in the Owner's sole discretion and without waiving any other remedies, may elect either to:

.1 deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due to Contractor from the Owner, or

.2 issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use; all Project systems included in the Work or designated portion thereof have been successfully tested and are fully operational; all required governmental inspections and certifications required of the Work have been made, approved and posted; designated initial instruction of Owner's personnel in the operation of Project systems has been completed; and all the required finishes set out in the Construction Documents are in place. The only remaining Work shall be minor in nature so that the Owner can occupy the Work or the applicable portion of the Work for all of its intended purposes on that date; and the completion of the Work by the Contractor will not materially interfere with or hamper Owner's normal school operations or other intended use. As a further condition of a determination of Substantial Completion, the Contractor shall certify that all remaining Work shall be completed within 30 days. Contractor shall complete Owner's Substantial Completion Certificate.

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§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, then the Architect shall so notify the Contractor and Owner in writing, and the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. Except with the consent of the Owner, the Architect shall perform no more than five inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare, sign and issue Owner's ~~a~~ Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of ~~Substantial~~ Final Completion of the Work or designated portion ~~thereof unless otherwise provided in the Certificate of Substantial Completion~~.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. ~~Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.~~

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§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when ~~such portion is designated by separate agreement with~~ agreed to by the Owner and the Contractor in writing, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided that the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work resulting from such occupancy, use or installation, and property and liability insurance, ~~and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents~~. ~~When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2.~~ Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect. Contractor agrees that the Owner may place and install as much equipment and furnishings as is possible before completion or partial completion of portions of the Work.

§ 9.9.2 Immediately prior to such partial occupancy, ~~or~~ use, or installation, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon in writing, partial occupancy or use of a portion or portions of the Work or installation of furnishings and equipment shall not constitute acceptance of Work not complying with the requirements of the Contract Documents, nor shall it constitute evidence of Substantial Completion or Final Completion.

§ 9.9.4 In the event that Owner takes partial occupancy or installs furnishings and equipment prior to Substantial Completion of the Project, Contractor shall obtain an endorsement to Contractor's Builder's Risk Policy to provide extended coverage for partial occupancy if Contractor's Builder's Risk Coverage required by Article 11 would not otherwise provide such coverage.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly prepare, sign, and issue Owner's Certificate of Final Completion and a final Certificate for Payment ~~stating that to the best of the Architect's knowledge, information and belief~~ certifying to the Owner that, ~~and~~ on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance, including all retainages, found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. Final payments shall be made by the Owner in accordance with Owner's regular schedule for payments.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) using AIA Document G706, an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) ~~a certificate evidencing~~ evidence satisfactory to Owner that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) using AIA Document G707, consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) ~~if required by the Owner~~except for amounts previously withheld by the Owner, other data establishing payment or satisfaction of obligations, such as AIA Document G706A, notarized subcontractor's lien releases, receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the

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Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees. In addition, the following items must be completed and received by the Owner before Final Payment will be due:

.1 Written certifications required by Sections 10.5, 10.6, and 10.7;

.2 Final list of subcontractors (AIA Document G705);

.3 Contractor's certification in Texas Education Agency's Certification of Project Compliance, located at www.tea.state.tx.us/school.finance/facilities/cert_2004.pdf;

.4 Contractor's warranties, organized as required elsewhere in the Contract Documents;

.5 Maintenance and Instruction Manuals;

.6 Owner's Final Completion Certificate; and

.7 "As-constructed record drawings". At the completion of the Project, the Contractor shall submit one complete set of "as-constructed" record drawings, with all changes made during construction, including concealed mechanical, electrical, and plumbing items. The Contractor shall submit these as electronic, sepia, or other acceptable medium, in the discretion of the Owner. The "as-constructed" record drawings shall delete the seal of the Architect and/or the Engineer and any reference to those firms providing professional services to the Owner, except for historical or reference purposes.

Documents identified as affidavits must be notarized. All manuals will contain an index listing the information submitted. The index section will be divided and identified by tabbing each section as listed in the index. Upon request, the Architect will furnish the Contractor with blank copies of the forms listed above. Final payment shall be paid by the Owner to the Contractor within thirty (30) days after Owner's Board of Trustees has voted to accept the Work and approve Final Payment.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, ~~except that~~and it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall not constitute a waiver of any Claims by the Owner~~, except those arising from~~

~~.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;~~
~~.2 failure of the Work to comply with the requirements of the Contract Documents;~~
~~.3 terms of special warranties required by the Contract Documents; or~~
~~.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.~~

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously asserted pursuant to Article 15 ~~made in writing~~ and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract and shall conform to all provisions of the "Manual of Accident

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Prevention in Construction", published by the Associated General Contractors of America, Inc., latest edition, and the Contractor further agrees to fully comply with all safety standards required by the Occupational Safety and Health Administration ("OSHA") 29 USC Section 651 et seq., and all amendments thereto. However, the Contractor's duties herein shall not relieve any Subcontractor or any other person or entity, including any person or entity required to comply with all applicable federal, state and local laws, rules, regulations, and ordinances, from the obligation to provide for the safety of their employees, persons, and property and their requirements to maintain a work environment free of recognized hazards. Contractor shall provide reasonable fall protection safeguards and provide approved fall protection safety equipment for use by all exposed Contractor employees.

§ 10.1.2 Contractor's employees, agents, Subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, shall not perform any service for Owner while under the influence of any amount of alcohol or any illegal controlled substance; or use, possess, distribute, or sell alcoholic beverages while on Owner's premises. No person shall: use, possess, distribute, or sell illegal or nonprescribed controlled drugs or drug paraphernalia; misuse legitimate prescription or over-the-counter drugs; or act in contravention of warnings on medications while performing the Work or while on Owner's premises. Contractor's employees, agents, Subcontractors, or anyone directly or indirectly employed by any of them, shall not distribute or sell alcohol or drugs of any kind to Owner's students or staff, regardless of the location of the distribution or sale.

§ 10.1.3 Contractor will comply with all applicable federal, state, and local drug and alcohol-related laws and regulations (e.g., Department of Transportation regulations, Drug-Free Workplace Act). Contractor has adopted or will adopt its own policy to assure a drug-free and alcohol-free workplace while on Owner's premises or performing the Work. Contractor will remove any of its employees, agents, subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, from performing the Work any time there is suspicion of alcohol and/or drug use, possession, or impairment involving such person, and at any time an incident occurs where drug or alcohol use could have been a contributing factor. Owner has the right to require Contractor to remove any person from performing the Work any time cause exists to suspect alcohol or drug use. In such cases, the person so removed may only be considered for return to work after the Contractor certifies, as a result of a for-cause test, conducted immediately following removal, that said person was in compliance with this Contract. Contractor will not use any person to perform the Work who fails or refuses to take, or tests positive on, any for-cause alcohol or drug test.

§ 10.1.4 Owner has also banned the presence of all weapons on the Project site, whether or not the owner thereof has a permit for a weapon, and Contractor agrees that Contractor's representatives, employees, agents, and subcontractors will abide by same. Weapons may only be permitted in Owner's parking lots if weapons are locked in personal vehicles in Owner's parking lot.

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§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work, school personnel, students, and other persons on Owner's premises, and other persons who may be affected thereby, including the installation of fencing between the Work site and any connecting or adjacent property of Owner, when required by Texas Education Code Section 22.08341;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as other buildings, and their contents, fencing, trees, shrubs, lawns, walks, athletic fields, facilities and tracks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including installing fencing, posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites

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and utilities of the safeguards. The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any personal or real property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor.

§ 10.2.4 When use or storage of ~~explosives or other~~ hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel and shall only conduct such activities after giving reasonable advance written notice of the presence or use of such materials, equipment, or methods to Owner and Architect. The storage of explosives on Owner's property is prohibited. The use of explosive materials on Owner's property is prohibited unless expressly approved in advance in writing by Owner and Architect.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. ~~The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.~~ The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 The Contractor shall do all things reasonably necessary to protect the Owner's premises and all persons from damage and injury when all or a portion of the Work is suspended for any reason.

§ 10.2.9 The Contractor shall promptly report in writing to the Owner and Architect all accidents arising out of or in connection with the Work which cause death, bodily injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious bodily injuries, or serious property damages are caused, then the accident shall be reported immediately by any means necessary to give actual notice to the Owner's representative and the Architect.

§ 10.2.10 Contractor's obligations under Section 10.2 as to each portion of the Project shall continue until Owner takes possession of and occupies that portion of the Project.

§ 10.2.11~~8~~ Injury or Damage to Person or Property

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The written notice shall provide sufficient detail to enable the other party to investigate the matter. Contractor understands and acknowledges that, under Texas law, Owner has sovereign and/or governmental immunity as to all torts except as to the Owner's permitted use or operation of Owner's motor vehicles, subject to any defenses under law.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify in writing the Owner and Architect of the

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condition. In the event the Contractor encounters polychlorinated biphenyl (PCB), and the specifications require the PCB's removal, the Contractor shall remove the PCB and store it in marked containers at the jobsite provided by the Owner. If PCBs are found which are leaking, then Contractor shall stop work on the affected fixture and shall contact Owner for removal and disposal of the leaking PCBs.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. ~~By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.~~ The Contractor may be entitled to an equitable adjustment regarding the Date of Substantial Completion and/or Final Completion.

§ 10.3.3 ~~To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.~~ IF CONTRACTOR IMPORTS HAZARDOUS MATERIALS ONTO THE PROJECT SITE, THEN CONTRACTOR HEREBY INDEMNIFIES AND HOLDS HARMLESS THE OWNER, ITS CONSULTANTS, TRUSTEES, OFFICERS, AGENTS AND EMPLOYEES, AGAINST ANY CLAIMS ARISING OUT OF OR RELATED TO SUCH IMPORTATION, INCLUDING BUT NOT LIMITED TO COSTS AND EXPENSES THE OWNER INCURS FOR REMEDIATION OF A MATERIAL OR SUBSTANCE THE CONTRACTOR BRINGS TO THE SITE, AS PROVIDED FOR IN SUBPARAGRAPH 3.18.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site ~~unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances~~.

§ 10.3.5 ~~The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.~~

§ 10.3.6 ~~If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.~~

§ 10.4 Emergencies

§ 10.4.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. ~~Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.~~

§ 10.4.2 The performance of the foregoing services by the Contractor shall not relieve the subcontractors of their responsibility for the safety of persons and property and for compliance with all federal, state and local statutes, rules, regulations and orders of any governmental authority applicable to the conduct of the Work.

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§ 10.5 ASBESTOS OR ASBESTOS-CONTAINING MATERIALS

§ 10.5.1 Contractor shall submit to the Architect a written certification addressed to the Owner that all materials used in the construction of this Project contain less than 0.10% by weight of asbestos and for which it can be demonstrated that, under reasonably foreseeable job site conditions, will not release asbestos fibers in excess of 0.1 fibers per cubic centimeter. The written certification shall further state that, should asbestos fibers be found at this Project in concentrations greater than 0.1 fibers per cubic centimeter, then Contractor shall be responsible for determining which materials contain asbestos fibers and shall take all necessary corrective action to remove those materials from the Project, at no additional cost to the Owner. The written certification shall be dated, shall reference this specific Project and shall be signed by not less than two (2) officers of the Contractor.

§ 10.5.2 Final Payment shall not be made until this written certification has been received.

§ 10.6 LEAD-FREE MATERIAL IN POTABLE WATER SYSTEM

§ 10.6.1 Prior to payment of retainage and final payment, the Contractor and each subcontractor involved with the potable water system shall furnish a written certification that the potable water system is "lead-free".

§ 10.6.2 The written certification shall further state that should lead be found in the potable water system built under this Project, then Contractor shall be responsible for determining which materials contain lead and shall take all necessary corrective action to remove lead from the Project, at no additional cost to the Owner. The written certification shall be dated, shall reference this specific Project and shall be signed by not less than two (2) officers of the Contractor.

§ 10.7 HAZARDOUS MATERIALS CERTIFICATION

The Contractor shall provide written certification that no materials used in the Work contain lead or asbestos materials in them in excess of amounts allowed by federal, state or local standards, laws, codes, rules and regulations; the Federal Environmental Protection Agency (EPA) standards; and/or the Federal Occupational Safety and Health Administration (OSHA) standards, whichever is most restrictive. The Contractor shall provide this written certification as part of submittals under the Section in the Project Manual related to Contract Closeout.

ARTICLE 11 INSURANCE AND BONDS

§ 11.0.1 No Work will be commenced, and no equipment or materials can be shipped, until all requirements of this Article have been satisfied, satisfactory evidence of insurance has been provided, and all insurance is in full force and effect. Contractor shall notify Owner and Architect in writing of any proposed nonconformity with these requirements, and shall notify Owner and Architect in writing of any insurance changes which occur during the terms required under the Contract Documents. Any deviation from these requirements can only be approved by Owner's Board of Trustees. Any nonconformity may be grounds for termination or modification of the Contract. To the extent that Contractor is unable to procure the insurance designated herein because the insurance is not reasonably available or is cost-prohibitive, then Contractor shall provide written notice to Owner's Board of Trustees. Said lack of insurance may then be grounds for termination or modification of this Agreement.

§ 11.0.2 Satisfactory evidence of insurance required by this Article shall be provided to Owner and Architect not later than five business days after execution of the Contract by Owner. Satisfactory evidence shall include copies of all required insurance policies, declarations, and endorsements themselves. In addition, Contractor shall also provide a duly-executed ACORD Form 25 Certificate of Liability Insurance naming Owner as a certificate holder and additional insured (except as noted in Section 11.0.4) and attaching all endorsements required herein. The Contractor shall furnish Owner all insurance amendments, renewals, notices, cancellations, and additional endorsements, as they are provided to Contractor.

§ 11.0.3 All insurance required herein shall be obtained from a company licensed to do business in the State of Texas by the Texas Department of Insurance, and shall be underwritten by a company rated not less than A-X in A.M. Best's Key Rating Guide, Property-Casualty, according to the latest posted ratings available on A.M. Best's website, www.ambest.com, and that permits waivers of subrogation.

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§ 11.0.4 All insurance required herein shall name the Owner, its officers, employees, representatives, or agents, as an additional insured, except Contractor's Worker's Compensation insurance.

§ 11.0.5 All insurance required herein shall, by endorsement, be primary and non-contributory insurance with respect to the Owner, its officers, employees, representatives, or agents. All insurance shall be written on an occurrence basis, if available, and shall contain a waiver of subrogation in favor of Owner as provided for in Section 11.3.

§ 11.0.6 Any failure of Contractor to comply with the reporting provisions of the policies shall not affect the coverage provided to the Owner, its officers, employees, representatives, or agents.

§ 11.0.7 All workers on the Project must be covered by the required insurance policies of the Contractor or a Subcontractor.

§ 11.0.8 Nothing contained in this Article shall limit or waive Contractor's legal or contractual responsibilities to Owner or others.

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor and the Contractor's Subcontractors shall purchase and maintain such insurance as will protect them and the Owner from claims that may arise out of, or result from, the Contractor's operations under the Contract, whether such operations be by Contractor or by any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, at a minimum, of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in this Section 11.1, in the Agreement, or elsewhere in the Contract Documents. ~~The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.~~ Such insurance shall include the following:

.1 Claims under workers' compensation, disability benefit, and other similar employee benefit acts that are applicable to the Work to be performed, including private entities performing work at the site, and exempt from the coverage on account of number of employees or occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the Project (see Exhibit A);

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person, or property damage arising out of ownership, maintenance, or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations;

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under the Contract Documents, including under Section 3.18; and

.9 Claims for damages to the Work itself, through builder's risk insurance, pursuant to AIA 101-2017, Exhibit A.

§ 11.1.2 ~~The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.~~

§ 11.1.2.1 The Contractor shall furnish separate payment and performance bonds covering faithful performance of the Contract and payment of obligations arising thereunder, each bond to be in a total amount equal to 100% of the

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Contract Sum or Guaranteed Maximum Price, if the Project is a Construction Manager at Risk project, whichever is applicable. Provided, however, no limitation herein shall limit Contractor's liability under the Contract Documents. Except as provided below, such bond shall be furnished to Owner before any work begins and not later than five business days after execution of the Contract by Owner. (If the Guaranteed Maximum Price is not known at the time that a Construction Manager at Risk contract is awarded, then the sum of the payment and performance bonds must each be in an amount equal to the Project budget. The Construction Manager at Risk shall deliver the bonds not later than the tenth day after the date the Construction Manager at Risk executes the Contract, unless the Construction Manager at Risk furnished a bid bond or other financial security acceptable to the Owner to the District to ensure that the Construction Manager will furnish the required payment and performance bonds when the Guaranteed Maximum Price is established.) All bonds shall be issued by a surety company licensed, listed and authorized to issue bonds in the State of Texas by the Texas Department of Insurance, and shall fully comply with Texas Insurance Code Section 3503.001 et seq. and Texas Government Code Chapter 2253, or their successors. The surety company shall have a rating of not less than "A-X" according to the latest posted ratings on the A.M. Best website, www.ambest.com. The surety company shall provide, if requested, information on bonding capacity and other projects under coverage and shall provide proof to establish adequate financial capacity for this Project. Should the bond amount be in excess of ten percent (10%) of the surety company's capital and surplus, then the surety company issuing the bond shall certify that the surety company has acquired reinsurance, in a form and amount acceptable to the Owner, to reinsure the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus with one or more reinsurers who are duly authorized and admitted to do business in Texas and that amount reinsured by a reinsurer does not exceed ten percent (10%) of the reinsurer's capital and surplus. Contractor shall immediately notify the Owner and Architect in writing if there is any change in: the rating; insolvency or receivership in any State; bankruptcy; right to do business in the State; or status of Contractor's sureties at any time until Final Completion.

§ 11.1.2.2 The Contractor shall deliver copies of the required bonds to the Owner and Architect not later than five business days after execution of the Contract by Owner. All bonds will be reviewed by the Architect for compliance with the Contract Documents. In the event that the Architect has any questions concerning the sufficiency of the bonds, the bonds will be referred to the Owner or the Owner's Representative with Architect's recommendation.

§ 11.1.2.3 All bonds shall be originals. The Contractor shall require the attorney-in-fact who executes the required Bonds on behalf of the Surety to affix thereto a certified and current copy of the power-of-attorney. The name, address, and telephone number of a contact person for the bonding company shall be provided.

§ 11.1.2.4 Bonds shall guarantee the faithful performance of all of the covenants, stipulations, and agreements of the Contract. Bonds shall be signed by an agent, resident in the State of Texas. If at any time during the continuance of the Contract, the Owner determines that the Contractor is unable to complete the Work in accordance with the Contract Documents, any of the Contractor's bonds become insufficient, the surety becomes insolvent, or the surety's rating drops below the required level, then the Owner shall have the right to require from the Contractor additional and sufficient sureties or other security acceptable to the Owner, which the Contractor shall furnish to the satisfaction of the Owner within ten (10) days after notice to do so. These contractual remedies are in addition to all remedies available by law. In default thereof, all payment or money due to the Contractor may be withheld until the Contractor provides additional surety or security.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor ~~becomes aware~~knows or should know of an impending or actual cancellation ~~or expiration~~ of any insurance required by the Contract Documents, the Contractor shall provide written notice to the Owner of such impending or actual cancellation ~~or expiration~~. Upon receipt of written notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of written notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage. At least 30 calendar days prior to the date of expiration of any policy required by Section 11.1, Contractor shall provide Owner written notice of the impending expiration.

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§ 11.2 Owner's Insurance

§ 11.2.1 ~~The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.~~ The Owner shall be responsible for purchasing and maintaining property and casualty insurance no later than the date of Substantial Completion and such date of Owner responsibility shall be documented in the Certificate of Substantial Completion. If Owner occupies or uses any completed or partially-completed portion of the Work at any stage, then such occupancy or use must be consented to by the insurer and authorized by public authorities having jurisdiction over the Work. To the extent of overlap between Owner's property insurance and Contractor's builder's risk insurance, if any, Contactor's builder's risk shall be primary and non-contributory.

§ 11.2.2 Partial occupancy or use shall not commence until the insurance company providing this insurance has consented in writing, by endorsement or otherwise. Owner and Contractor shall take reasonable steps to obtain such consent and shall take no action without written mutual consent that would cause cancellation, lapse, or reduction of this insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 All insurance required herein shall contain a waiver of subrogation in favor of Owner on all claims arising out of the Project. The policies shall provide such waivers of subrogation by endorsement or otherwise. The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity whether or not: (1) ~~even though~~ that person or entity would otherwise have a duty of indemnification, contractual or otherwise;~~,~~ (2) ~~even though~~ that person or entity paid or did not pay the insurance premium directly or indirectly, or (3) ~~whether or not~~ the person or entity had an insurable interest in the damaged property.

§ 11.4 Loss of Use~~, and~~ Business Interruption~~, and Delay in Completion~~ Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. ~~The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.~~

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of ~~any applicable mortgagee clause and of~~ Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor and Architect of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor and the Architect shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor and/or the Architect do~~es~~ not object, the Owner shall settle the loss and the Contractor and Architect shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor and/or Architect timely object~~s~~ to either the terms of the proposed settlement or the allocation of the proceeds, the

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Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's or Owner's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect or Owner, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect or Owner may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor ~~shall~~ may be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or Work failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.1.1 The Owner may make emergency repairs to the Work or take such other measures necessary under the circumstances, if the Contractor does not promptly respond to a notice of defect or nonconforming Work. Contractor shall be responsible to Owner for this cost if the reason for the repairs is attributable to the Contractor. If payments then or thereafter due to the Contractor are not sufficient to cover such costs, then the Contractor shall pay the difference to the Owner on demand.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof ~~or after the date for commencement of warranties established under Section 9.9.1,~~ or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such written notice promptly after discovery of the condition. ~~During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.~~ If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of written notice from the Owner or Architect, the Owner may correct the Work as provided in 12.2.2.1.1. Nothing contained in this Section 12.2 is intended to limit or modify any obligations under the law or under the Contract Documents, including any warranty obligations, expressed or implied ~~it in accordance with Section 2.5~~.

§ 12.2.2.1.1 If the Contractor fails to perform the corrective Work, then Owner may perform corrective Work, at Contractor's cost. If Owner performs corrective Work, then Owner may also remove nonconforming Work and store the salvageable materials or equipment at Contractor's expense. If the Contractor does not pay all costs incurred by Owner within ten (10) days after written notice, then Owner may, upon ten (10) additional days' written notice, sell the removed materials and equipment in accordance with Owner's policies, and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, then the Contractor shall pay the difference to the Owner.

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§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall ~~not~~ be extended by corrective Work performed by the Contractor pursuant to this Section 12.2, but only as to the corrected Work.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction ~~of~~ by the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.2.6 Contractor shall replace, repair, or restore any parts of the Project or furniture, fixtures, equipment, or other items placed therein (whether by Owner or any other party) that are- destroyed or damaged by any such parts of the Work that do not conform to the requirements of the Contract Documents or by defects in the Work.

§ 12.2.7 The provisions of this Section 12.2 apply to Work done by Subcontractors of the Contractor as well as Work done directly by employees of the Contractor. The provision for this Section 12.2.7 shall not apply to corrective work attributable solely to the acts or omissions of any separate contractor of Owner (unless Contractor is acting in such capacities). The cost to Contractor of performing any of its obligations under this Section 12.2.7 to the extent not covered by insurance shall be borne by Contractor.

§ 12.2.8 If, however, Owner and Contractor deem it inexpedient to require the correction of Work damaged or not done in accordance with the Contract Documents, then an equitable deduction from the Contract Sum shall be made by written agreement between Contractor and Owner. Until such settlement, Owner may withhold such sums as Owner deems just and reasonable from moneys, if any, due Contractor. The settlement shall not be unreasonably delayed by the Owner and the amount of money withheld shall be based on estimated actual cost of the correction to Owner.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

§ 13.1.1 The Contract shall be governed by the laws of the State of Texas, and any litigation shall be conducted in state district court. Mandatory and exclusive venue for any disputes shall be in the county in which the Project is located. ~~place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.~~

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. ~~Except as provided in Section 13.2.2, n~~Neither party to the Contract shall assign the Contract, in whole or in part, ~~as a whole~~ without

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written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 ~~The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment~~. The invalidity of any part or provision of the Contract Documents shall not impair or affect in any manner whatsoever the validity, enforceability, or effect of the remainder of the Contact Documents.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner~~,~~ or Architect~~, or Contractor~~ shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made at appropriate times as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities having jurisdiction. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals which shall be included in the Cost of the Work. Provided, however, per Texas Government Code Chapter 2269, Owner shall bear all costs of construction materials engineering, testing and inspection services, and the verification testing services necessary for acceptance of the facility by the Owner. The Contractor shall give the Architect timely written notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. ~~The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded.~~ The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Owner shall provide or contract ~~the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements~~ for such additional testing, inspection, or approval~~, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures~~. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense. Architect, Owner and Contractor shall cooperate for the timely scheduling of such tests and inspections.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including, but not limited to, those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect, with a copy to the Owner.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Undisputed ~~P~~payments due and unpaid under the Contract Documents shall bear interest from the date payment is overdue at the rate as provided by Texas Government Code Section 2251.025. ~~the parties agree upon in writing or,~~

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~~in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~ Any such payment shall be deemed overdue on the thirty-first day after Owner received Architect's invoice or Contractor's completed Application for Payment for the Architect, whichever is later, if Owner's Board of Trustees meets more than once per month. Any such payment shall be deemed overdue on the forty-sixth day after Owner receives Architect's invoice or Contractor's Certificate for Payment from the Architect, if Owner's Board of Trustees meets once a month or less frequently. No interest shall be due on sums properly retained by Owner, except as provided by law, or on disputed sums unpaid by Owner.

§ 13.6 EQUAL OPPORTUNITY IN EMPLOYMENT

§ 13.6.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, age, disability, sex, ~~or~~ national origin, or any class otherwise protected by District policy or law. The Contractor agrees to post in conspicuous places, available to employees and applicants, notices setting forth the Contractor's nondiscrimination policies.

§ 13.6.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, age, disability, sex, national origin, or any class otherwise protected by District policy or law.

§ 13.7 RECORDS

§ 13.7.1 Contractor shall at all times through the date of Final Completion, maintain Job Records, including, but not limited to, invoices, Construction Documents, payment records, payroll records, daily reports, diaries, logs, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda, other financial data and job meeting minutes applicable to the Project, in a manner which maintains the integrity of the documents. Job Records must be retained by Contractor for at least twelve (12) years after the date of Final Completion of the Project. Within 10 days of Owner's request, Contractor shall make such Job Records available for inspection, copying and auditing by the Owner, Architect or their respective representatives, at Owner's central office.

§ 13.7.2 If Contractor is a Construction Manager at Risk, then Contractor shall also maintain, in accordance with the provisions of Section 13.7.1, the following: subcontract files, including proposals of successful and unsuccessful bidders, bid recaps and subcontractor payments; original estimates; estimating work sheets; general ledger entries detailing cash and trade discounts received; insurance rebates and dividends; and any other supporting evidence deemed necessary by the Owner to substantiate charges related to the Contract.

§ 13.7.3 Contractor shall keep a full and detailed financial accounting system and shall exercise such controls as may be necessary for proper financial management under this Contract; the accounting and control systems shall be satisfactory to the Owner and shall be subject to the provisions of Section 13.7.1.

§ 13.7.4 Contractor shall keep all Contract Documents related to the Project, subject to the provisions of Section 13.7~~9~~.1, provided, however, Contractor shall not destroy said documents until Contractor has confirmed with Owner in writing that Owner has obtained a copy of all as-built drawings.

§ 13.7.5 In the event that an audit by the Owner reveals any errors/overpayments by the Owner, then the Contractor shall refund to the Owner the full amount of such overpayments within thirty (30) days of such audit findings, or the Owner, at its option, reserves the right to deduct such amounts owed to the Owner from any payments due to the Contractor.

§ 13.8 PROPRIETARY INTERESTS AND CONFIDENTIAL INFORMATION

§ 13.8.1 Neither Architect nor Contractor shall use the image or likeness of Owner's Project or Owner's official logo or emblem and any other trademark, service mark, or copyrighted or otherwise protected information of Owner, without Owner's prior written consent. Contractor and Architect shall not have any authority to advertise or claim that Owner endorses Architect or Contractor's services, without Owner's prior written consent.

§ 13.8.2 Neither Architect nor Contractor shall disclose any confidential information of Owner which comes into the possession of Architect or Contractor at any time during the Project, including but not limited to: pending real estate purchases, exchange, lease, or value; information related to litigation; the location and deployment of security

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devices; security access codes; student likenesses; student record information; employee information; or any other information deemed confidential by law.

§ 13.8.3 The parties acknowledge that, as a public entity in the State of Texas, Owner is subject to, and must comply with, the provisions of the Texas Public Information Act, Texas Government Code Section 552.001, *et seq.*, and the Texas Open Meetings Act, Texas Government Code, Section 551.001, *et seq.*

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of ninety ~~3~~90 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped; or

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment of undisputed sums due on an approved Certificate for Payment within the time stated in the Contract Documents~~;. or~~

.4 ~~The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.~~

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, then, after the applicable time period, the Contractor may, upon ~~seven~~ten (10) days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, and for proven unrecoverable loss with respect to materials, equipment, tools, and construction equipment and machinery incurred to the date of termination ~~as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination~~.

§ 14.1.4 If the Work is stopped for a period of ninety ~~6~~ (90) consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon ~~seven~~ twenty (20) additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or ~~s~~Suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or ~~s~~Suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; ~~or~~

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents~~;~~.

.5 fails to furnish the Owner, upon written request, with assurances satisfactory to the Owner, evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;

.6 engages in serious or repeated worker misconduct in violation of Article 3.3.2;

.7 engages in conduct that would constitute a violation of state or federal criminal law, including but not limited to, the laws prohibiting certain gifts to public servants, or engages in conduct that would constitute a violation of the Owner's ethics or conflict of interest policies; or

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.8 fails to proceed continuously and diligently with the construction and completion of the Work, except as permitted under the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, subject to any prior rights of the surety, ~~and upon certification by the Architect that sufficient cause exists to justify such action,~~ the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished. Any further payment shall be limited to amounts earned to the date of termination.

§ 14.2.4 ~~If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.~~ If the costs of finishing the Work, including compensation for the Architects' services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, exceed the unpaid balance of the Contract Sum or Guaranteed Maximum Price, (if the Project is a Construction Manager at Risk project), then the Contractor and/or its Surety shall pay the difference to the Owner. The amount to be paid to the Owner shall be certified by Architect upon application. The obligation for payment shall survive termination of the Contract.

§ 14.2.5 The parties hereby agree that: 1) if an order for relief is entered on behalf of the Contractor, pursuant to Chapter 11 of the U.S. Bankruptcy Code; 2) if any other similar order is entered under any debtor relief laws; 3) if Contractor makes an assignment for the benefit of one or more of its creditors; 4) if a receiver is appointed for the benefit of its creditors; or 5) if a receiver is appointed on account of its insolvency, any such event could impair or frustrate Contractor's performance of the Contract Documents. Accordingly, it is agreed that upon occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of the Contract Documents. Failure to comply with such request within ten (10) days of delivery of the request shall entitle Owner to terminate the Contract and to the accompanying rights set forth in Subparagraphs 14.2.1 through 14.2.6. In all events, pending receipt of adequate assurance of performance and actual performance in accordance with the Contract Documents, Owner shall be entitled to proceed with the Work with Owner's own forces or with other Contractors on a time and material or other appropriate basis, the cost of which will be charged against the Contract Sum.

§ 14.2.6 As required by Texas Government Code Chapter 2253, if a Performance Bond has been furnished and the Contractor is declared by the Owner to be in default under the Contract, then the Surety shall promptly perform the Work, in full accordance with the plans, specifications and Contract Documents. Unless otherwise agreed in writing between the Surety and the Owner, the Surety shall complete the Work by the Surety entering into a Contract acceptable to Owner, with a Contractor acceptable to Owner, and shall obtain new Payment and Performance Bonds as required by law.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum, Guaranteed Maximum Price, and Contract Time ~~shall~~ may be adjusted, by mutual written agreement, for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. ~~Adjustment of the Contract Sum shall include profit.~~ No adjustment shall be made to the extent

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.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. Furthermore, if this Contract is a multi-year contract funded through Owner's current general funds that are not bond funds, then the Owner's Board of Trustees has the right to not appropriate adequate monies for the next fiscal year and to terminate this Contract at the end of each fiscal year during the term of the Contract, without the Owner incurring any further liability to Contractor as a result of such termination.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed~~; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.~~ and for proven unrecoverable loss with respect to materials, equipment, tools, and construction equipment and machinery incurred to the date of termination. Such payment shall not cause the Contract Sum, or Guaranteed Maximum Price, if the Project is a Construction Manager at Risk Project, to be exceeded. Such payment shall not include overhead and profit for Work not executed.

§ 14.4.4 Upon determination by a Court of competent jurisdiction that termination of the Contractor pursuant to Section 14.2 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Section 14.4, and Contractor's remedy for wrongful termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Section 14.4

ARTICLE 15 CLAIMS AND DISPUTES OF CONTRACTOR

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by the Contractor ~~one of the parties~~ seeking, as a matter of right, payment of ~~money~~ additional compensation under the Contract Documents, interpretation of the Contract Document terms, a change in the Contract Time~~,~~ or other relief with respect to the terms of the Contract. ~~The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract.~~ The responsibility to substantiate Claims shall rest with the ~~party~~Contractor ~~making the Claim.~~ This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Litigation ~~Claims~~

The Owner and Contractor shall commence all litigation ~~Claims and causes of action against the other and arising out of or related to the Contract,~~ whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the ~~binding~~ dispute resolution method selected in the Agreement and within the period specified by applicable law, but in ~~any~~ the case of the Owner, not more than 12~~0~~ years after the date of Final~~Substantial~~ Completion of the Work. The Owner and Contractor waive all ~~Claims and~~ causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by ~~either~~ the ~~Owner or~~ Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by written notice to the ~~other party~~ Owner and to the ~~Initial Decision Maker with a copy sent to the~~ Architect~~, if the Architect is not serving as the Initial Decision Maker~~. Claims by Contractor ~~either party~~ under this Section 15.1.3.1 ~~shall~~must be

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initiated within 21 calendar days after occurrence of the event giving rise to such Claim or within 21 calendar days after the Contractor ~~claimant~~ first knew or should have known ~~recognizes~~ the condition giving rise to the Claim, whichever is earlier ~~later~~. Claims must be initiated by written notice titled "Notice of Claim" ("Notice") and sent to the Architect and Owner's designated representatives. The Notice shall clearly set out the specific matter of complaint, and the impact which may occur or have occurred as a result thereof, to the extent that the impact can be assessed at the time of the Notice. If the impact cannot be assessed as of the date of the Notice then the Notice shall be amended at the earliest date that is reasonably possible. It is imperative that Owner receive timely specific Notice of any potential problem identified by Contractor in order that the problem can be mitigated or resolved promptly. A notice of intent to sue for monetary damages must be given within ninety-one (91) days after the occurrence of the event giving rise to such claim or within ninety-one (91) days after the Contractor first knew or should have known of the condition giving rise to the cause of action, whichever is earlier or the cause of action for monetary damages shall be waived. Pursuant to Texas Civil Practices and Remedies Code Section 16.071, Contractor agrees that this is a reasonable notice requirement.

§ 15.1.3.2 Claims by ~~either~~ the ~~Owner or~~ Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by written notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7, as amended, and Article 14, as amended, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make undisputed payments for Work performed in accordance with the Contract Documents.

§ 15.1.5 Claims for Additional Cost or An Increase in the Contract Sum or Guaranteed Maximum Price

If the Contractor wishes to make a Claim for additional cost or an increase in the Contract Sum or Guaranteed Maximum Price, written notice as provided in Section 15.1.3 shall be given to Owner and Architect ~~before proceeding to execute the portion of the Work that is the subject of the Claim~~. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. The Architect will promptly investigate such Claim and report findings and a recommended resolution in writing to the Owner and Contractor. If the Claim is approved by Owner's Board of Trustees, or Owner's representative if provided for herein, then Contractor shall proceed with the execution of the Work that is the subject matter of the Claim. If the Claim is rejected by the Owner, then Contractor may pursue alternative dispute resolution as provided for in the Contract Documents.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of ~~cost and of~~ probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and prevented the execution of major items of work on normal working days. ~~had an adverse effect on the scheduled construction~~. "Adverse weather conditions" means unusually severe weather which is beyond the normal weather recorded and expected for the locality and/or the season or seasons of the year.

§ 15.1.6.3 The Contractor shall anticipate and include in the construction schedule rain days due to adverse weather conditions in accordance with the rainfall table below. A rain day is defined as a day when rainfall exceeds one-half (.5) inch during a 24-hour period. The number of rain days expected for each month is as follows:

Note: Prior to the execution of the Contract, Owner shall fill in the blanks below:

January	[5] calendar days	July	[4] calendar days
February	[4] calendar days	August	[4] calendar days
March	[5] calendar days	September	[5] calendar days
April	[6] calendar days	October	[4] calendar days

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May	[6] calendar days	November	[4] calendar days
June	[4] calendar days	December	[4] calendar days

§ 15.1.6.4 Time extensions may be granted for rain days in any month when the cumulative number of rain days during that month exceeds the number scheduled, provided that the rainfall prevented the execution of major items of work on normal working days. No day will be counted as a rain day when substantial Contractor forces are able to perform Work on the Project for more than fifty percent (50%) of the usual workday or when the stage of the Work on the Project is not adversely impacted. The number of rain days shown in the above schedule for the first and last months of the Contract will be prorated in determining the total number of rain days expected during the period of the Contract.

§ 15.1.6.5 No extension of time shall be made to the Contractor because of hindrances or delays from any cause which is the fault of Contractor or Contractor's Subcontractors or under Contractor's control. Claims for extension of time may only be considered because of rain delays, or because of hindrances or delays which are the fault of Owner and/or under Owner's control, but only to the extent that Substantial Completion of the Project is adjusted beyond the original Substantial Completion date. Only claims for extension of time shall be considered because of hindrances or delays not the fault of either Contractor or Owner, but only to the extent that Substantial Completion of the Project exceeds the Substantial Completion date established for the Work. Board approval shall be required for any extension of time. No damages shall be paid for delays. Contractor shall only be entitled to time extensions per the terms of the Contract Documents.

§ 15.1.6.6 Requests for time extension shall be submitted on a monthly basis and shall specify the time delay, the cause of the delay, and the responsible party for the delay, whether Contractor, Owner, rain day, or other. No claims for damages for delay shall be made by Contractor. Any claim not submitted under the terms of this Section shall be waived.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor ~~and Owner~~ waives all Claims against Owner ~~each other~~ for consequential damages arising out of or relating to this Contract, including, but not limited to, any amount owed as compensation for the increased cost to perform the Work as a direct result of Owner-caused delays or acceleration. ~~This mutual waiver includes~~

.1 ~~damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and~~

.2 ~~damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.~~

~~This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14.~~ Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 ~~Initial Decision~~Resolution of Claims and Disputes

§ 15.2.1 ~~Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.~~

Claims by the Contractor against the Owner, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for written recommendation. An initial recommendation by the Architect shall be required as a condition precedent to mediation or litigation of all Claims by the Contractor arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Architect with no recommendation having been rendered by the Architect.

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§ 15.2.2 ~~The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.~~ The Architect shall review Claims and within ten days of the receipt of the Claim take one of the following actions: (1) request additional supporting data from the Contractor, or (2) make a written recommendation to the Owner, with a copy to the Contractor.

§ 15.2.3 In evaluating Claims, the Architect ~~Initial Decision Maker~~ may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect~~Initial Decision Maker~~ in making a written recommendation.~~rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense~~.

§ 15.2.4 If the Architect ~~Initial Decision Maker~~ requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either ~~(1)~~ provide a response on the requested supporting data, ~~(2)~~ advise the Architect~~Initial Decision Maker~~ when the response or supporting data will be furnished, or ~~(3)~~ advise the Architect ~~Initial Decision Maker~~ that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 ~~The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.~~ Following receipt of the Architect's written recommendation regarding a Claim, the Owner and Contractor shall attempt to reach agreement as to any adjustment to the Contract Sum or Guaranteed Maximum Price and/or Contract Time. If no agreement can be reached, then either party may request mediation of the dispute pursuant to Section 15.3.

§ 15.2.6 ~~Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.~~Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.3 ~~Mediation~~Alternative Dispute Resolution

§ 15.3.1 ~~Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.~~Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived under the terms of the Contract Documents, shall, after written recommendation by the Architect or 30 days after submission of the Claim to the Architect, be subject to mediation at the request of either party. Owner and Contractor expressly agree that mediation shall be a condition precedent to the initiation of any litigation arising out of such Claims. Claims for injunctive relief shall not be subject to this Section.

§ 15.3.2 ~~The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~ The parties shall endeavor to resolve their Claims by mediation. Requests for mediation shall be filed in writing with the other party to the

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Contract. Mediation shall be subject to and in accordance with Chapter 154 of the Texas Civil Practice & Remedies Code. Mediation shall be conducted by a mutually-agreed-upon mediator. In the event that the parties are unable to agree on a mediator, then the parties shall jointly request the appointment of a neutral mediator by a District Judge in the county in which the Project is located.

§ 15.3.3 ~~The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.~~ The parties shall share the mediator's fee equally and, if any filing fee is required, shall share said fee equally. Mediation shall be held within the county where the Owner's main administrative office is located, unless another location is mutually agreed upon by the parties. Agreements reached in mediation shall be reduced to writing, considered for approval by the Owner's Board of Trustees, signed by the parties if approved by the Board of Trustees, and, if signed, shall thereafter be enforceable as provided by the laws of the State of Texas.

§ 15.3.4 Any claim not resolved in mediation shall be subject to litigation pursuant to Section 13.1.

§ 15.4 No Arbitration

§ 15.4.1 ~~If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.~~ Notwithstanding anything to the contrary in the Contract Documents or in any document forming a part hereof, there shall be no mandatory arbitration for any dispute arising hereunder.

§ 15.4.1.1 ~~A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.~~

§ 15.4.2 ~~The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

§ 15.4.3 ~~The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

§ 15.4.4 ~~**Consolidation or Joinder**~~

§ 15.4.4.1 ~~Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).~~

§ 15.4.4.2 ~~Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.~~

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§ 15.4.4.3 ~~The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.~~

§ 15.5 Contractor stipulates that Owner is a political subdivision of the State of Texas, and, as such, enjoys immunities from suit and liability provided by the Constitution and laws of the State of Texas. By entering into this Agreement, Owner does not waive any of its immunities from suit and/or liability, except as otherwise specifically provided herein and as specifically authorized by law.

§ 15.6 In any adjudication under this Agreement, reasonable and necessary attorneys' fees may be awarded to the prevailing party.

EXECUTED this _____ day of _____, _____.

OWNER:	**CONTRACTOR:**
_____	_____
(Printed Name)	**By:** _____
Title: President, Board of Trustees	**Title:** _____
Birdville Independent School District	

ATTEST:

_____
By: _____
Title: Secretary, Board of Trustees
Birdville Independent School District

DRAFT

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Prevailing Wage Rate Determination Information

The following information is from Chapter 2258 Texas Government Code:

2258.021. Right to be Paid Prevailing Wage Rates.

(a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
  (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
  (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.
(b) Subsection (a) does not apply to maintenance work.
(c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

2258.023. Prevailing Wage Rates to be Paid by Contractor and Subcontractor; Penalty.

(a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.
(b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.
(c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.
(d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.
(e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

2258.051. Duty of Public Body to Hear Complaints and Withhold Payment.

A public body awarding a contract, and an agent or officer of the public body, shall:

(1) take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
(2) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.

Prevailing Wage Rates - School Construction Trades

Texas - Dallas / Fort Worth Area

CLASSIFICATION	HOURLY RATE	NOTES
Asbestos Worker	$15.95	
Bricklayers; Masons	$20.25	
Carpenter/Caseworker	$17.78	
Concrete Finishers	$16.50	
Data Comm / Telecom Installers	$23.33	
Drywall/Ceiling Installers	$17.85	
Electricians	$22.35	
Elevator Mechanics	$38.01	
Fire Proofing Installer	$19.75	
Glaziers	$19.08	
Heavy Equipment Operator	$20.89	
Insulators	$17.00	
Iron Workers	$19.95	
Laborers	$13.08	
Lather / Plasterer	$16.42	
Light Equipment Operators	$14.74	
Metal Building Assemblers	$16.57	
Millwrights	$19.33	
Painters/Wall Covering Installers	$16.70	
Pipefitters	$24.68	
Plumbers	$24.06	
Roofers	$19.31	
Sheet Metal Workers	$17.55	
Sprinkler Fitters	$20.17	
Steel Erector	$21.75	
Terrazzo Workers	$15.67	
Tile Setters	$16.33	
Water Proofers / Caulkers	$14.60	

This document was developed by PBK Architects, Inc. in strict accordance with the Texas Government Code Chapter 2258.

Prevailing Wage Rates
Worker Classification Definition Sheet

Asbestos Worker	Worker who removes & disposes of asbestos materials.
Carpenter	Worker who builds wood structures or structures of any material which has replaced wood. Includes rough & finish carpentry, hardware and trim.
Carpet Layer/Floor Installer	Worker who installs carpets and/or floor coverings-vinyl tile.
Concrete Finisher	Worker who floats, trowels and finishes concrete.
Data Comm/Telecom Installer	Worker who installs data/telephone & television cable and associated equipment and accessories.
Drywall/Ceiling Installer	Worker who installs metal framed walls & ceilings, drywall coverings, ceiling grids & ceilings.
Electrician	Skilled craftsman who installs or repairs electrical wiring & devices. Includes fire alarm systems &HVAC electrical controls.
Elevator Mechanic	Craftsman skilled in the installation & maintenance of elevators.
Fire Proofing Installer	Worker who sprays or applies fire proofing materials.
Glazier	Worker who installs glass, glazing and glass framing.
Heavy Equipment Operator	Includes, but not limited to, all Cat tractors, all derrick-powered, all power operated cranes, back-hoe, back-filler, power operated shovel, winch truck, all trenching machines.
Insulator	Worker who applies, sprays or installs insulation.
Iron Worker	Skilled craftsman who erects structural steel framing & installs structural concrete Rebar.
Laborer/Helper	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials & tools, hauling, digging, clean-up.
Lather/Plasterer	Worker who installs metal framing & lath. Worker who applies plaster to lathing and installs associated accessories.
Light Equipment Operator	Includes, but not limited to, air compressors, truck crane driver, flex plane, building elevator, form grader, concrete mixer (less than 14cf), conveyer.
Mason	Craftsman who works with masonry products, stone, brick, block or any material substituting for those materials & accessories.
Metal Building Assembler	Worker who assembles pre-made metal buildings.
Millwright	Mechanic specializing in the installation of heavy machinery, conveyance, wrenches, dock levelers, hydraulic lifts & align pumps.
Painter/Wall Covering Inst.	Worker who prepares wall surfaces & applies paint and/or wall coverings, tape and bedding.
Pipefitter	Trained worker who installs piping systems, chilled water piping & hot water (boiler) piping, pneumatic tubing controls, chillers, boilers & associated mechanical equipment.
Plumber	Skilled craftsman who installs domestic hot & cold water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
Roofer	Worker who installs roofing materials, Bitumen (asphalt & coal tar) felts, flashings, all types roofing membranes & associated products.
Sheet Metal Worker	Worker who installs sheet metal products. Roof metal, flashings & curbs, ductwork, mechanical equipment and associated metals.
Sprinkler Fitter	Worker who installs fire sprinkler systems & fire protection equipment.
Terrazzo Worker	Craftsman who places & finishes Terrazzo.
Tile Setter	Worker who prepares wall and/or floor surfaces & applies ceramic tiles to these surfaces.
Waterproofer/ Caulker	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membrane, liquid membranes, sprayed, rolled or brushed.

END OF DOCUMENT

DOCUMENT 00 73 50

WEATHER TABLE

MONTH	AVERAGE DAYS RAIN (1)	INCHES RAINFALL (2)	SNOW/ICE PELLETS (3)
JANUARY	6.5	2.13	0.1
FEBRUARY	6.4	2.67	0.3
MARCH	7.8	3.47	0.1
APRIL	6.7	3.03	0.0
MAY	9.1	4.90	0.0
JUNE	8.0	3.85	0.0
JULY	4.5	2.17	0.0
AUGUST	4.7	1.91	0.0
SEPTEMBER	5.4	2.55	0.0
OCTOBER	7.4	4.21	0.0
NOVEMBER	6.4	2.71	0.0
DECEMBER	6.7	2.58	0.1
ANNUALLY	79.6	36.18	0.6

(1) Mean number of days rainfall, 0.01" or more.
(2) Average normal precipitation, in inches.
(3) Mean number of days 1.0" or more.
* Less than 0.05".

This table is based on information reported from Dallas/Fort Worth International Airport, Texas. Latitude 32.898° N, longitude 97.019° W, elevation (ground) 560 feet.

Means are based on records covering a period of 30 years. Normals based on record for the 1981-2010 period.

END OF SECTION

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Document 00 21 16 - Instructions to Proposers.
   2. Document 00 70 00 - General Conditions of the Contract for Construction: Provisions for use of site; Owner occupancy; Relations of Contractor - subcontractors.
   3. Document 00 73 00 - Supplementary Conditions to the Contract for Construction.
   4. Section 01 32 16 - Construction Progress Schedules: Format of work schedule.
   5. Section 01 45 23 - Testing and Inspection Services.
   6. Section 01 50 00 - Temporary Facilities and Controls.

1.2 DESCRIPTION

A. The work comprises the construction of Gymnasium Addition to Smithfield Middle School for Birdville Independent School District, North Richland Hills, Texas, as shown on the drawings and described in the specifications. The work will be done under one lump sum contract.

B. Indication on the drawings or mention in the specifications of articles, materials, operations or methods requires that the Contractor provide each item indicated or mentioned of the quality or subject to the qualifications noted, and perform according to the conditions stated each operation described and provide therefor all necessary labor, equipment, services and incidentals.
   1. Subcontractors are responsible for examining the architectural drawings for structural, mechanical, electrical, and plumbing items. Items shown on these drawings shall be furnished by the appropriate subcontractor.

1.3 CONDITIONS OF THE CONTRACT

A. The General Conditions (Modified) bound herewith as preceding portions of these specifications, form a part thereof and shall govern the work under each section.

1.4 EXISTING SITE CONDITIONS

A. Visit and examine the site. Upon award of the Contract, the Contractor shall accept the condition of the site before beginning the work required.

1.5 SPECIAL REQUIREMENTS

A. The present building houses an operating facility that must continue in operation during the construction period, except as the Architect and Owner may otherwise direct. Plumbing, heating, ventilating, electrical and telephone systems shall continue to function with a minimum of interruptions in service. Do not block required fire exits.

B. Assume responsibility for the protection of areas of work and provide and maintain protections required. Protect existing surfaces of the building and equipment, both interior and exterior, as required during the construction period. Provide necessary dust screens, drop cloths and temporary walls and/or coverings as may be required for protection. Existing surfaces that are damaged due to construction shall be patched or replaced to original condition.

C. Where designated on the drawings, salvage, relocate and reinstall certain items. Existing items so designated shall be properly installed, securely fastened as required, set plumb and level and left complete and operational. Exercise extensive care in relocating such items so as to prevent damage. Other existing building materials indicated to be removed or demolished, unless noted otherwise or claimed by the Owner shall become property of the Contractor and shall be removed from the site immediately.

D. Wherever exterior walls are to be demolished or existing doors replaced, the exposed portion of the existing building shall be protected by the Contractor against the elements, construction debris and intrusion by unauthorized persons, by means subject to approval of the Architect.

E. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Following execution of a Substantial Completion Certificate for a designated portion of the work, the Contractor shall permit:
   1. Access for Owner personnel.
   2. Use of parking facilities for the benefit of the Owner.
   3. Operation of HVAC and electrical systems for the benefit of the Owner.

   Despite partial Owner occupancy, the Contractor shall remain responsible for portions of the work which have not attained Substantial Completion and for which a Substantial Completion Certificate, which shall designate the date on which the Owner shall become responsible for utilities, maintenance, security, damage to the work and insurance, has not been executed.

F. The loop fire lane and fire hydrants are required by the City to be in place and operational during construction at existing buildings and prior to steel erection at new buildings.

1.6 SEQUENCE OF CONSTRUCTION

A. Work shall be started upon formal “Notice-to-Proceed” and shall be substantially complete by June 30, 2020.

B. Submit Federal Aviation Administration (FAA) Form 7460-1 and any other necessary forms to satisfy FAA requirements. The contractor shall also be responsible for any fees and modifications to construction methods due to FAA requirements. This may include, but not be limited to, the use of two cranes in lieu of one.

C. The Contractor agrees that, from the compensation otherwise to be paid, the Owner may retain the sum of $1,000.00 for each calendar day after the Date of Substantial Completion that the work remains incomplete. This sum is agreed upon as the proper measure of Liquidated Damages which the Owner will sustain per diem by the failure of the Contractor to complete the work at the time stipulated in the Contract. This sum is not to be construed in any sense a penalty.

D. PHASE 1: Commence the work of Phase 1 on or before a date to be established in the written “Notice-to-Proceed” of the Owner. The Substantial Completion date shall be June 30, 2020.

E. The successful Contractor may propose alternatives to this sequence of construction that would accelerate the work, provided there is no increase in the contract amount or extension of the contract time, or, in the Owner's judgment, any activity that would disrupt, impede, or prohibit normal school operations. Proposals shall be submitted in writing and are subject to the approval of the Owner and Architect.

1.7 CONTRACTOR USE OF PREMISES

A. The existing soil erosion control system will be maintained and removed by the General Contractor. All contractors will be required to modify, repair, adjust and add to the erosion control system as required to accommodate their work.

B. Limit use of premises for work, for storage and for access, to allow for Owner occupancy.

C. Coordinate use of premises under direction of Owner.

D. Assume full responsibility for protection and safekeeping of products under this contract.

E. Obtain and pay for use of additional storage or work areas needed when required for operations under this Contract.

F. During construction the Owner will continue to perform normal activities in and around the adjacent existing building. Proper and safe access to the Owner-occupied areas shall be maintained. Interruption of mechanical and electrical services to the building shall be only at such times and for lengths of time as approved by the Owner.

G. There shall be no storage of materials or equipment in the occupied portions of the existing building. There shall be no fires on the site or in the building. There shall be no dumping on Owner's property.

H. After the site package contractor delivers the site grading substantially complete as certified by his surveyor, the building General Contractor shall assume responsibility for all site grades. The building General Contractor shall maintain and repair any erosion as required until a full stand of grass is established.

I. Worker Identity Badging Requirements: Provide construction personnel (including subcontractors and suppliers regularly visiting the project site) with identification badges, with photograph. Identification badges shall be worn visibly by construction personnel on the construction site or on Owner's property. NO EMPLOYEE WILL BE PERMITTED ON SITE WITHOUT THIS BADGE DISPLAYED ON THE EMPLOYEE. Contractor must assure that the Crisis Management contact information is provided on the reverse side of each worker's badge. Temporary or visitor badges will be provided for persons who are identified as having an infrequent or temporary legitimate business need for access to the site.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed on the project site during normal business working hours of 6:00 a.m. to sundown, Monday through Friday, or City ordinance whichever is more restrictive.
   1. Weekend Hours: Comply with City ordinance restrictions for weekend work.. No work shall be performed on Sundays, unless specifically allowed by City and Owner.
   2. Early Morning Hours: Comply with City noise ordinances for restriction of early-morning concrete pours and other noisy construction activities. Owner's testing laboratory personnel will be available only during on-site work hours listed above.

B. Work Restrictions within Existing Building(s): Work shall be generally performed inside the existing building during the summer break and after normal school classes Monday through Friday. During student holidays when the faculty and staff may be on campus, extent of work and utility interruption shall be coordinated with the Owner in advance. On dates designated as STAAR testing days, work within the existing building is not allowed and work in other areas may need to be limited to keeping down the amount of noise and distraction for the students. Work on these days shall be coordinated with the Owner in advance.

1.9 OWNER-FURNISHED PRODUCTS

A. Contractor Responsibilities
   1. Protect products from damage.
   2. Repair or replace items damaged by Contractor.

B. Schedule of Owner-furnished items / Contractor Installed
   1. Toilet Tissue Dispensers, Twin and Three Roll
   2. Soap Dispensers
   3. Interior Signage

1.10 COORDINATION

A. Drawing details and other sections of these specifications covering work connected with or relating to that specified under a specific heading shall be examined for conditions which may affect that part of the work. Failure to do so will not relieve those furnishing materials and/or labor under a specification heading from supplying materials or performing work reasonably necessary to properly coordinate their work with that of other trades.

1.11 LAYING OUT WORK, MEASUREMENTS

A. Employ a competent engineer or surveyor to establish and maintain lines and levels. Establish and maintain at least two elevation bench marks remote from each other and located outside the building area. Set alignment and location stakes.

B. Verify measurements at the building. No extra compensation will be allowed for differences between actual dimensions and dimensions indicated on the drawings. Figured dimensions and measurements taken at the site shall take precedence over scaled dimensions.

1.12 DISCREPANCIES

A. In case of discrepancies within the drawings, within the specifications, or between the drawings and specifications, the better quality and greater quantity, in the opinion of the Architect, shall be furnished and installed.

1.13 PIPING

A. Should active piping or conduit be encountered below grade within the building structure and be found at variance with the known conditions indicated by the drawings and specifications, said piping and/or conduit shall be relocated as required by the Architect, and the contract sum shall be fairly adjusted on the basis of the cost of labor and materials. The Contractor shall provide temporary support of active piping and conduit encountered in the excavations until permanently supported or removed. The Contractor shall cut off and cap or plug abandoned lines at least 3 ft. outside the building lines. Conform to the applicable requirements of the locality or governing agency.

1.14 PROTECTION

A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy in adjacent spaces and around the site.
   1. Confine operations to areas within Contract limits indicated. Portions of the building which are outside the areas construction operations are indicated, are not to be disturbed.
   2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees. Do not use these areas for parking or storage of materials without prior approval. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
   3. Do not dispose of organic and hazardous material on site, either by burial or by burning. Disposable material and trash must be removed properly.

B. Assume responsibility for the premises and provide and maintain protections required by the governing laws, regulations and ordinances. The Contractor shall be responsible for loss or damage caused by him or his workmen to the property of the Owner or to the work or materials installed, and shall make good loss, damage or injury without cost to the Owner.

C. The protection of adjacent property shall include but will not necessarily be limited to the erection and maintenance of shoring, underpinning and fences as necessary to protect and support existing work to be left in place.

D. Finished floors shall be protected against damage by workmen and equipment during the work. Where materials are carried into the building, the building floors shall be covered to protect the work against dirt or grit being ground in.

E. Where existing roofing, flashing, exterior walls, doors and windows are removed, the openings and exposed portions of the construction shall be covered and protected so as to be weathertight until new work is in place.

F. Where work is being done on the existing building, the furniture, fixtures and equipment in the building shall be covered with heavy plastic sheeting or clean tarpaulins to protect the property against damage and stains. The furniture and equipment shall not be removed from the building.

G. Trees and shrubs on the site which do not have to be removed for the new work shall be protected against damage. No Contractor shall remove or trim trees and shrubs in the area without the express approval of the Architect.

H. Send proper notices, make necessary arrangements and perform other services required for the care, protection and maintenance of Public Utilities, including fire plugs and wires and other items of this character on and around the building site.

I. Maintain accessible building exits required by the City during construction. Protection of these exits shall include dust-proof enclosures, illumination and exit lighting required.

J. While school is in session, provide appropriate measures to control the migration of dust and odors into occupied areas of the school.

1.15 CUTTING AND PATCHING

A. Cutting and chasing of existing construction for relocation of mechanical and electrical work and for installation of pipes and ducts will be done by the trades concerned. Patching and finishing shall be done by the Contractor. This work shall be done with proper tools and by careful workmen of the particular trade to which such work belongs and shall be done without extra cost to the Owner.

1.16 RECORD DRAWINGS

A. Maintain a complete clean set of drawings and Project Manual in the project field office for the sole purpose of recording "installed" conditions. Installed conditions shall include addendum items, change orders, or other items which come up during the construction phase which deviate from the Construction Documents. Changes made in these drawings and Project manual in connection with the final construction and installation shall be neatly made in red ink. Upon completion of the project, the marked set of drawings and Project Manual shall be delivered to the Architect for subsequent transmittal to the Owner. These drawings shall be maintained to reflect the current conditions of the work and changes shall be reviewed on a monthly basis with the Architect’s representative. The Contractor's updating of the "installed" condition drawings and Project Manual shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

1.17 INSTRUCTIONS CONCERNING ASBESTOS

A. In the event the Contractor encounters on the site material reasonably believed to be asbestos which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the Owner in writing. If, in fact the material is asbestos and has not been rendered harmless, the work in the affected area shall not thereafter be resumed until the asbestos has been removed or rendered harmless by the Owner. The work in the affected area shall be resumed in the absence of asbestos, or when it has been rendered harmless, by written agreement of the Owner and Contractor.

B. The Contractor will not be required to perform without consent work relating to asbestos.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

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SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements governing allowances.
   1. Certain materials and equipment are specified in the contract documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by change order.

B. Related Requirements:
   1. General Conditions of the Contract for Construction.
   2. Section 01 32 16 - Construction Progress Schedules: Product delivery and installation dates.
   3. Individual Specifications Sections Listed Under Schedule of Allowances: Specification of products and installation under allowances.

1.2 COSTS INCLUDED IN ALLOWANCES

A. Cost of product to Contractor or subcontractor, less applicable trade discounts.

B. Delivery to site.

C. Applicable taxes.

1.3 CONTRACTOR COSTS INCLUDED IN CONTRACT SUM

A. Products handling at site, including unloading, uncrating and storage.

B. Protection of products from elements and from damage.

C. Labor for installation and finishing.

D. Other expenses required to complete installation.

E. Contractor overhead and profit.

1.4 ADJUSTMENT OF COSTS

A. Should the net cost be more or less than the specified amount of the allowance, the contract sum will be adjusted accordingly by change order.

B. Submit any claims for anticipated additional costs at the site, or other expenses caused by the selection under the allowance, prior to execution of the work.

C. Submit documentation for actual additional costs at the site, or other expenses caused by the selection under the allowance, prior to execution of the work.

D. Failure to submit claims within the designated time will constitute a waiver of claims for additional costs.

1.5 ARCHITECT RESPONSIBILITIES

A. Consult with Contractor in consideration of products, suppliers and installers.

B. Select products, obtain Owner's written decision, and transmit full information to Contractor as follows
   1. Manufacturer, product, model or catalog number, accessories, attachments and finishes.
   2. Supplier and installer as applicable.
   3. Cost to Contractor, delivered to site (and installed, if so specified).

1.6 CONTRACTOR RESPONSIBILITIES

A. At the earliest practical date after award of the contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the work.

B. Assist Architect in determining suppliers; and installers; obtain proposals when requested.

C. Make recommendations for Architect consideration.

D. Promptly notify Architect of any reasonable objections against supplier or installer.

E. On notification of selection execute purchase agreement with designated supplier and installer.

F. Arrange for and process shop drawings, product data and samples.

G. Arrange for delivery. Promptly inspect products upon delivery for completeness, damage and defects. Submit claims for transportation damage.

H. Install, adjust and finish products.

I. Provide warranties for products and installation.

1.7 CORRELATION WITH CONTRACTOR SUBMITTALS

A. Schedule shop drawings, product data, samples and delivery dates, in progress schedule for products selected under allowances.

PART 2 - PRODUCTS – Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate allowance work with related work to ensure proper integration and interface.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Allow the lump sum of $30,000.00 for HVAC Testing and Air Balancing.

B. Allowance No. 2: Allow the lump sum of $150,000.00 Owner’s Contingency for the changes requested by the Owner.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Applications and Certificates for Payment.
   2. Change Order Procedures.
   3. Schedule of Values: Submit to the Architect the Schedule of Values allocated to various portions of the work within five days after "Notice-to-Proceed". Upon request of Architect, support values with data which will substantiate their correctness.

B. Related Requirements:
   1. Conditions of the Contract for Construction.
   2. Section 01 32 16 - Construction Progress Schedules.
   3. Section 01 77 00 - Closeout Procedures.
   4. Section 01 78 39 - Project Record Documents.

1.2 APPLICATIONS AND CERTIFICATES FOR PAYMENT

A. Progress payments shall be made as the work proceeds at intervals stated in the Contract.

B. Work covered by progress payments shall, at the time of payment, become the property of the Owner.

C. Form of Application and Certificate for Payment shall be notarized AIA Document G702 - Application and Certification for Payment, supported by AIA document G703 - Continuation Sheet. Submit two hard copies. Architect will retain a digital copy and return signed hard copies to the Owner and Contractor.

D. Conditions governing regular schedule for applications, payment and retainage are as stated in the Contract.

E. With each Application for Payment, Contractor shall certify that such Application for Payment represents a just estimate of cost reimbursable to Contractor under terms of Contract.

1.3 CONSTRUCTION CHANGE ORDER PROCEDURES

A. Contractor to submit to Architect within five days of execution of Owner/Contractor Agreement name of individual authorized to accept changes on behalf of Contractor, and to be responsible for informing others in Contractor's employ of changes in the work.

B. Change Order forms will be furnished and issued by Architect.

C. Contractor Documentation of Changes:
   1. Maintain detailed records of work done on an accounting basis acceptable to Architect and Owner. Provide full information required for evaluation of proposed changes.
   2. Document each quotation for a change in cost or time with sufficient data to allow evaluation of quotation.
   3. On request, provide additional data to support computations:
      a. Quantities of products, labor and equipment.
      b. Insurance and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   4. Support each request for additional costs, and for work proposed on a time and material basis, with description of products, equipment, cost of labor and subcontracts, completely documented.
   5. Computation for changes in work will be computed in one of the manners described in the Conditions of the Contract.

D. Initiation of Changes:
   1. Architect may submit Proposal Request which includes detailed description of change with supplementary or revised drawings and specifications.

2. Contractor may initiate a proposed change by submittal of a request to Architect describing proposed change with statement of reason for change, and proposed effect on Contract Sum and Contract Time with full documentation and a statement of the effect on work of separate contractors. Document any requested substitutions in accordance with SECTION 01 62 00 - PRODUCT OPTIONS. Submission of such requests and receipt of same by Architect does not mean acceptance, or approval of proposed change.

E. Authorization:
1. The Owner may request, through the Architect, a Construction Change Directive, in writing, instructing Contractor to proceed with changes of all or in part of work, for subsequent inclusion in a Change Order that is pending. Directive will propose basis for necessary adjustments, if any, to Contract Sum or Time.
2. Changes that affect Contract Sum and/or Contract Time will require a Change Order signed by the Owner and the Architect. Contractor's signature indicates agreement. Other orders, written or oral, by the Owner through the Architect or by the Architect shall be treated as a Change Order only if Contractor gives Owner proper written notice as described in Conditions of Contract.
3. Promptly execute the change in work only upon receipt of approved Change Order or Owner's written Construction Change Directive.

F. Execution:
1. Architect will issue Change Orders for signatures of parties as provided in Conditions of Contract.
2. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust Contract Sum as shown on Change Order.
3. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by Change, and resubmit Schedule.
4. Promptly enter Changes in Project Record Documents.

1.4 SCHEDULE OF VALUES FORM AND CONTENT

A. Type schedule on 8-1/2" x 11" white paper; Contractor's standard forms and automated printout will be considered for approval by Architect upon Contractor's request. Identify schedule with:
1. Title of project and location.
2. Architect and Architect's project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Follow the table of contents of this project manual as the format for listing component items.
1. Identify each line item with the number and title of the respective major section of the specifications.

C. For each major line item list sub-values of major products or operations under the item.

D. For the various portions of the work:
1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
2. For items on which progress payments will be requested for stored materials, break down the value into:
a. Cost of the materials, delivered and unloaded, with taxes paid.
b. Total installed value.

E. The sum of values listed in the schedule shall equal the total contract sum.

F. Indicate separate value associated with materials and labor.

G. Re-submittal: After review by Architect, revise and resubmit schedule as necessary.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Coordination of work of the contract.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Sequence of construction and Owner occupancy.
2. Section 01 31 19 - Project Meetings.
3. Section 01 62 00 - Product Options.
4. Section 01 73 29 - Cutting and Patching.
5. Section 01 77 00 - Closeout Procedures: Closeout submittals.

1.2 DESCRIPTION

A. Coordinate scheduling, submittals and work of the various sections of specifications to ensure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

B. Coordinate sequence of work to accommodate Owner occupancy as specified in SECTION 01 11 00 - SUMMARY OF WORK.

1.3 MEETINGS

A. In addition to progress meetings specified in SECTION 01 31 19 - PROJECT MEETINGS, hold coordination meetings and pre-installation conferences with personnel and subcontractors to ensure coordination of work.

1.4 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals specified in SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Coordinate work of various sections having interdependent responsibilities for equipment, such as installing, connecting to and placing in service.

C. Coordinate requests for substitutions to ensure compatibility of space, of operating elements and effect on work of other sections.

1.5 COORDINATION OF SPACE

A. Coordinate use of project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on drawings. Follow routings shown for pipes, ducts and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance and for repairs.

B. In finished areas, except as otherwise shown, conceal pipes, ducts and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

1.6 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation for substantial completion of portions of work designated for Owner partial occupancy.

B. After Owner occupancy of premises, coordinate access to site by various sections for correction of defective work and work not in accordance with contract documents, to minimize disruption of Owner's activities.

C. Assemble and coordinate closeout submittals specified in SECTION 01 77 00 - CLOSEOUT PROCEDURES.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling and administration of progress meetings.
   2. Pre-installation conferences.

B. Related Requirements:
   1. Section 01 31 00 - Project Management and Coordination.
   2. Section 01 31 19.13 - Preconstruction Meetings: Owner's preconstruction conference and pre-mobilization conference.
   3. Section 01 32 16 - Construction Progress Schedules.
   4. Section 01 33 23 - Shop Drawings, Product Data and Samples.
   5. Section 01 45 00 - Quality Control.
   6. Section 01 78 23 - Operation and Maintenance Data.
   7. Section 01 78 39 - Project Record Documents.

1.2 PROGRESS MEETINGS

A. The Architect will schedule and administer monthly construction progress meetings, throughout progress of work. He will prepare agenda and distribute notice of each meeting to participants

B. Contractor shall make physical arrangements.

C. Architect will preside at meetings.

D. Location of Meetings: Contractor's field office.

E. Attendance: Contractor, job superintendent, and Architect. Owner and professional consultants will attend as appropriate. Subcontractors and suppliers shall attend as Architect sees necessary to agenda.

F. Anticipated Agenda:
   1. Review of Contractor's updated Construction Schedule.
   2. Review of work in-progress.
   3. Field observations, problems and decisions.
   4. Identification of problems which impede planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to work.

1.3 PRE-INSTALLATION CONFERENCES

A. When required in individual specification section, convene a pre-installation conference at work site prior to commencing work of the section.

B. Require attendance of entities directly affecting, or affected by, work of the section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes and distribute copies within two days after conference to participants, with two copies to Architect.

E. Review conditions of installation, preparation and installation procedures and coordination with related work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 31 19.13

PRECONSTRUCTION MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Contractor participation in preconstruction meetings.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Administrative provisions.
2. Section 01 31 00 - Project Management and Coordination
3. Section 01 31 19 - Project Meetings.

1.2 PRECONSTRUCTION MEETING

A. Architect will schedule meeting within 15 days after notice of award.

B. Attendance: Owner, Architect, General Contractor and representatives of major subcontractors.

C. Agenda
1. Submittal of executed bonds and insurance certificates.
2. Execution of Owner-Contractor Agreement.
3. Distribution of Contract Documents.
4. Submittal of list of subcontractors, list of products, schedule of values and progress schedule.
5. Designation of responsible personnel.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal requests, change orders, allowances and Contract closeout procedures.
7. Scheduling.
8. Use of premises by Owner and Contractor.
9. Owner's requirements and occupancy.
10. Temporary facilities.
11. Survey and building layout.
12. Security and housekeeping procedures.
13. Procedures for testing.
14. Procedures for maintaining record documents.
15. Requirements for startup of equipment.
16. Accessibility Issues.
17. Inspection and acceptance of equipment put into service during construction period.
18. Notice to proceed.
19. Color samples.
20. Procedures for site meetings.
21. Site access and security.
22. Procedures and processing of TEA “Certification of Project Compliance” form.
23. Substantial and final project completion procedures.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedures for preparation and submittal of digital construction progress schedules and periodical updating.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Work sequence.
2. Section 01 29 00 - Payment Procedures: Schedule of Values.
3. Section 01 33 23 - Shop Drawings, Product Data and Samples.

1.2 SUBMITTALS

A. Within 10 days of the contract date, Contractor shall prepare and submit a digital Critical Path construction schedule for the work. After review, resubmit required revised data within 5 days.

B. Submit revised digital Critical Path Construction Schedule monthly with each Application for Payment.

C. Submit under transmittal letter specified in SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 WORK SCHEDULE FORMAT

A. The schedule shall not exceed time limits current under the Contract Documents and shall be subject to the approval of the Architect. The Contractor shall prosecute the work vigorously and make every effort to start and complete each phase of the work on or before the dates stated.

B. Should actual construction of project vary from the Critical Path schedule, Contractor shall take whatever actions are necessary to improve progress as quickly as possible in order to meet pre-determined milestones. Revise and re-submit schedule not less than every 30 calendar days. Presentation of the existing or updated Critical Path schedule, in three copies, along with the Certificate of Payment Request shall be a prerequisite to the monthly review of the payment request by the Architect's representative.

C. Sequence of Listings: The chronological order of the start of each item of work.

D. Scale and Spacing: To provide space for notations and revisions.

E. Sheet Size: Minimum 11" x 17".

1.4 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by major specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules for each stage of work identified in SECTION 01 11 00 - SUMMARY OF WORK.

E. Provide sub-schedules to define critical portions of entire schedule.

F. Show accumulated percentage of completion of each item, and total percentage of work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data and samples, including Owner furnished products and products specified under Allowances, and dates reviewed submittals will be required from Architect. Show decision dates for selection of finishes.

H. Show delivery dates for Owner furnished products and products specified under Allowances.

I. Coordinate content with SECTION 01 29 00 - PAYMENT PROCEDURES, Schedule of Values.

1.5 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken, or proposed and its effect.

1.6 DISTRIBUTION

A. Distribute copies of reviewed schedules to job site file, subcontractors, suppliers and other concerned entities.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Digital submission of shop drawings.

B. Related Requirements:
1. General Conditions of the Contract for Construction: Definitions and basic responsibilities of entities.
2. Section 01 31 00 - Project Management and Coordination: Coordination of submittals.
3. Section 01 32 00 - Construction Progress Schedules: Schedules for submittals.
4. Section 01 45 00 - Quality Control: Mockups and samples for testing.
5. Section 01 50 00 - Temporary Facilities and Controls: Project management software.
6. Section 01 60 00 - Product Requirements .
7. Section 01 78 23 - Operation and Maintenance Data.
8. Section 01 78 39 - Project Record Documents.

1.2 GENERAL

A. Refer to General Conditions, Paragraph 3.12 (for A201 & A201/CMA) (Shop Drawings, Product Data and Samples)

B. Digital Submittals: Submit to the Architect, or applicable consultant, shop drawings, product data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.
1. Submit using the Architect's web-based project management program (Projectmates). Prepare submittals as .pdf files, with a single file for each submittal, and upload to the Architect's project management program (Projectmates). Enter required data in program to fully identify submittal in accordance with the required submittal numbering format.

C. Within 10 days of the contract date Contractor shall prepare and submit with the Schedule of Values a comprehensive schedule of shop drawings, product data and samples. This schedule shall include products which are proposed for substitution. Also include the estimated date of each submittal and anticipated date of submittal return. Allow the Architect reasonable time to review submittals.
1. The schedule shall be compiled and submitted using the "Submittal" feature in the Architect's project management program (Projectmates).

D. Prepare schedule on basis of each specification section.

E. For products specified under reference standards, include with listing of each product:
1. Name and address of manufacturer.
2. Trade name.
3. Model or catalog designation.
4. Manufacturer's data, including performance and test data, reference standards.

1.3 SHOP DRAWINGS

A. Prepared by a qualified detailer. Prepare project-specific information, drawn accurately to scale. Do not base shop drawings on reproductions of the contract documents or standard printed data. Include supplier's / detailer's / manufacturer's title block.

B. Identify details by reference to sheet and detail numbers shown on Contract Documents.

C. Present in a clear and thorough manner original drawings which illustrate the portion of the work showing fabrication, layout, setting, or erection details, prepared by a qualified detailer. Title each drawing with Project and Contract name and number; identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.

1.4 PRODUCT DATA

A. Manufacturer's standard schematic drawings and diagrams:
   1. Modify drawings to delete information which is not applicable to the work.
   2. Supplement standard information to provide additional information specifically applicable to the work.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data:
   1. Clearly mark each copy to identify pertinent materials, products or models.
   2. Show dimensions and clearances required.
   3. Show performance characteristics and capacities.
   4. Show wiring or piping diagrams and controls.

C. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to specification section and Article number. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

1.5 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of product or material, with integrally related parts and attachment devices.
   2. Full range of color samples.

B. Color Selections & Samples: Provide two (2) samples for the Architect’s review and record. Provide cut sheet when applicable.
   1. Samples for Initial Selection: Submit one (1) full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer’s product line. Architect will return submittal with options selected. In addition to the physical samples required above, submit a .pdf file of photographs of the actual color samples and identifying labels.
   2. Samples for Verification: Submit two (2) full-size units or Sample of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection. In addition to the physical samples required above, submit a .pdf file of photographs of the actual color samples and identifying labels. Architect will retain physical samples.
      a. After Color Board has been delivered to the project site, submit one (1) sample for verification in lieu of two (2). One will be retained by Contractor for mounting on Color Board after approval by Architect.

C. Field Samples and Mock-ups:
   1. Erect at project site at location acceptable to Architect.
   2. Construct each sample or mock-up complete, including work of all trades required in finish work.
   3. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.

D. Digital Samples: In addition to the physical Office Samples and Field Samples/Mock-ups, submit a .pdf file of photographs of the actual samples/mock-ups.

E. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures and patterns, for Architect selection.

F. Submit samples to illustrate functional characteristics of products, including parts and attachments.

G. Approved samples which may be used in the work are indicated in the specification section.

H. Label each sample with identification required for transmittal letter.

1.6 CONTRACTOR REVIEW

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, quantities and details, manufacturer's catalog numbers and conformance of submittal with requirements of Contract Documents.

B. Coordinate submittals with requirements of work and of Contract Documents.

C. Sign or initial in a rubber-stamped review block format, each sheet of shop drawings and product data and each sample label to certify compliance with requirements of Contract Documents. Notify Architect in writing at time of submittal, of any deviations from requirements of Contract Documents.

D. Do not fabricate products or begin work which requires submittals until return of submittal with Architect acceptance.

E. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.

F. Contractor's responsibility for deviations in submittals from requirements of contract documents is not relieved by Architect's review of submittals, unless Architect gives specific written acceptance of deviations. Architect will review submittals for general conformance to design intent only.

1.7 SUBMISSION REQUIREMENTS

A. Submit Shop Drawings and Product Data as soon as practicable after award of contract but not later than 30 calendar days before dates reviewed submittals will be needed.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow 10 working days for review of each resubmittal.

C. Submit all office samples as soon as practicable but not later than 20 days after award of contract in order to facilitate color selections and coordination of the various materials. Final color selections and release of shop drawings contingent upon color selection will not be made until all office samples have been submitted, coordinated and approved.
   1. Color Board shall be delivered to the project site after 60 days. Contractor is responsible for updating color board with samples submitted by Contractor and approved by Architect after 60 days.

D. Digital Submittals: Submit to the Architect, or applicable consultant, shop drawings, product data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.
   1. The submittals shall be logged in by the General Contractor and tracked using the “Submittal” feature in the Architect’s project management program (Projectmates). All submittals shall be submitted in .pdf format.
      a. Submittals 8-1/2" x 11" and/or 11" x 17" and greater than 50 pages: Provide digital copy for the Architect’s records.
      b. Large Format Drawings (larger than 11 x 17): Provide digital copy for the Architect’s records.
   2. Architect will indicate, via markup on each digital submittal, the appropriate action, then return submittal via the Architect’s project management program (Projectmates).
   3. Submittals to be reviewed by consultants shall be submitted directly to the applicable consultant via ProjectMates with a copy simultaneously sent to the Architect. Submittals will be reviewed by the consultant and then delivered/transmitted to the Architect for his review prior to transmitting them to the contractor. Submittals to be reviewed by the testing lab shall be handled in the same manner.
   4. Color Selections & Samples: Reference “Samples” Article within this specification section.
   5. Submittals to be reviewed by consultants shall be submitted directly to the applicable consultant with a copy of only the digital transmittal simultaneously copied to the Architect. Submittals will be reviewed by the consultant and then delivered/transmitted to the Architect for his review prior to transmitting them to the contractor. Submittals to be reviewed by the testing lab shall be handled in the same manner.

E. Contractor is responsible for the costs associated with the digital delivery of all submittals, and hard copy where required, to the Architect and the Architect's consultants and retrieval of all submittals from the Architect, when necessary.

F. Accompany submittals with transmittal letter containing:
1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Identification of specification section and submittal numbers.
5. The number of each shop drawing, product data and sample submitted.
6. Notification of deviations from contract documents.
7. Other pertinent data.

G. Submittals shall include:
1. Date and revision dates.
2. Project title and number.
3. Names of Architect, Contractor, subcontractor, supplier and manufacturer.
4. Identification of product or material and specification section number.
5. Relation to adjacent structure, materials or other critical features.
6. Field dimensions, clearly identified as such.
7. Applicable reference standards.
8. A blank space 3" x 4" for Architect's stamp.
9. Identification of deviations from contract documents.
10. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements, and compliance with contract documents and coordination with requirements of the work. Note: Absence of the Contractor's stamp shall constitute grounds for rejection of the submittal until such time as the submittal has been processed in accordance with this requirement.
11. Other pertinent data required by specifications.

1.8 RE-SUBMISSION REQUIREMENTS

A. Re-submission: For shop drawings and product data not approved by Architect, make corrections and changes in submittals required by Architect and re-submit until approved.
1. The digital re-submission shall be logged in using the “Resubmit” feature in the Architect’s project management program (Projectmates).

B. Shop Drawings:
1. Revise initial drawings and re-submit as specified for initial submittal.
2. Indicate on drawings any changes which have been made, other than those requested by Architect.

C. Product Data and Samples: Submit new data and samples as specified for initial submittal

1.9 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Distribute reviewed submittal of shop drawings and product data which carry Architect's stamp as follows: Contractor's file, project site file, record documents file, other prime contractors.

B. Keep and maintain a full set of submittals throughout the construction phase to be submitted to the Architect with other Close-out documents for delivery to the Owner for his permanent record. Set of submittals shall be delivered to the Architect in cardboard file boxes with string and button type closures. Organize submittals by CSI divisions, utilizing neatly labeled pressboard dividers to separate the sections. Neatly label short end of box with project name, contents and duration of construction.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 35 00

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. General: The procedures and administrative requirements of this section apply to all of the sections of the specification which are involved in alterations to the existing building.
2. Extent Notes: Cut into or partially remove portions of the existing buildings as necessary to make way for new construction. Include such work as:
a. Cutting, moving, or removal of items shown to be cut, moved, or removed.
b. Cutting, moving, or removal of items not shown to be cut, moved, or removed, but which must be cut, moved, or removed to allow the new work to proceed. Work or items which are to remain in the finished work shall be patched or reinstalled after their cutting, moving, or removal, and their joints and finishes made to match adjacent or similar work.
c. Removal of existing surface finishes as needed to install new work or finishes.
d. Removal of abandoned items and removal of items serving no useful purpose, such as abandoned piping.
e. Repair or removal of dangerous or unsanitary conditions resulting from alterations work.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work; Sequence of construction and instructions concerning asbestos.
2. Section 01 50 00 - Temporary Facilities and Controls.
3. Section 01 73 29 - Cutting and Patching.
4. Section 01 74 13 - Progress Cleaning.
5. Section 02 41 19 - Selective Structure Demolition.

1.2 SCHEDULING AND ACCESS

A. Maintenance of Access and Operations: During period of construction, do not obstruct in any manner existing exit ways of Owner-occupied areas. Prior to removal of existing exit ways (stairs, corridors, doors) as part of new work, provide and maintain new exit ways so as to maintain same number of exit ways. Maintain existing fire doors in an operable condition.

B. Maintenance of Existing Services:
1. Maintain environmental control in existing buildings, especially temperature, humidity and dust control.
2. Provide temporary lines and connections as required to maintain existing mechanical and electrical services in buildings.
3. Notify Owner a minimum of seven days prior to each required interruption of mechanical or electrical services in buildings. Such interruptions shall be only at such times and for lengths of time as approved by the Owner. In no event shall interruption occur without prior approval of the Owner.

PART 2 - PRODUCTS

2.1 PRODUCTS FOR PATCHING EXTENDING WORK

A. New Materials: As specified in individual sections.

B. Match existing products and work for patching and extending work.

C. Determine type and quality of existing products by inspection and any necessary testing, and workmanship by use of existing as a standard. Presence of a product, finish, or type of work, requires that patching, extending, or matching shall be performed as necessary to make work complete and consistent with existing quality or specifications if more stringent.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that demolition is complete, and areas are ready for installation of new work.

B. Beginning of restoration work means acceptance of existing conditions.

3.2 PREPARATION

A. Cut, move, or remove items as necessary for access to alterations and renovations work; replace and restore at completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, rusted materials, and deteriorated masonry and concrete; replace materials as specified for finished work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Prepare surfaces and remove surface finishes to provide for proper installation of new work and new finishes.

E. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

3.3 INSTALLATION

A. Coordinate work of alterations and renovations to expedite completion.

B. Project shall be complete.

C. Remove, cut, and patch work in a manner to minimize damage and to provide means of restoring products and finishes to specified condition.

D. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent new finishes.

E. Install products as specified in individual sections.

3.4 ALTERATIONS, CUTTING, AND PROTECTION

A. Extent:
   1. Cutting and removal work shall be performed so as not to cut or remove more than is necessary and so as not to damage adjacent work.
   2. Conduct work in such a manner as to minimize noise and to minimize accumulation and spread of dirt and dust.
   3. Perform cutting for ductwork and other rectangular openings with carborundum saw with approved dust arrestor.
   4. Drill holes for conduit and piping using core drills.

B. Shoring, Bracing, and Capping: Provide shores, needling and bracing as needed to keep buildings structurally secure and free of deflection in all its parts, and as needed for installation of new structural members.

C. Responsibility and Assignment to Trades:
   1. Contractor shall assign the work of moving, removal, cutting, patching and repair to trades under his supervision so as to cause the least damage to each type of work encountered, and so as to return the buildings as much as possible to the appearance of new work.
   2. Patching of finish materials shall be assigned to mechanics skilled in the work of the finish trade involved.

D. Protection:
   1. Protect remaining finishes, equipment, and adjacent work from damage caused by cutting, moving, removal and patching operations. Protect surfaces which will remain a part of the finished work.
   2. Protect existing facilities and features, within designated construction limits and along corridor access route to construction area.

3. Cover existing wall and floor finishes in work areas, in adjacent areas, and along corridor access route to prevent damage from product delivery and construction operations. Use reinforced sheeting, listed by Underwriters' Laboratories, Inc., as having a flame spread rating of less than 25 and smoke developed rating of less than 50. Apply double thickness of sheeting, fastened to one side with no-tear fasteners. Tape joints continuously.
4. During demolition, cutting and construction, provide positive dust control by wetting dust debris and by completely sealing openings to Owner-occupied areas with temporary partitions, so as to prevent spread of dust and dirt to adjacent areas.
5. After materials, equipment and machinery are installed, properly protect work until final acceptance.
6. Damage resulting from construction operations shall be repaired by the Contractor without cost to the Owner.
7. During non-working hours, provide continuous security at openings cut into existing exterior walls and roofs.

E. Debris:
1. Remove debris promptly from the site each day. Removed material, except that listed or marked by the Architect for retention, becomes property of the Contractor. Load removed material directly on trucks for removal from site. Do not allow debris to enter sewers.
2. Do not let piled material endanger structure.
3. During cutting and coring operations, use metal lined wood box secured tight against surface, to catch falling debris and water.

3.5 PATCHING, EXTENDING, AND MATCHING

A. Skill: Patch and extend existing work using skilled mechanics who are capable of matching the existing quality of workmanship. The quality of patched or extended work shall not be less than that specified in the sections of the product and execution specifications which follow these general requirements.

B. Patching:
1. In areas where any portion of an existing finishing surface is damaged, lifted, stained, or otherwise made or found to be imperfect, patch or replace the imperfect portion of the surface with matching material.
2. Provide adequate support or substrate for patching of finishes.
3. If the imperfect surface was a painted or coated one, re-paint or re-coat the patched portion in such a way that uniform color and texture over the entire surface results.
4. If the surrounding surface cannot be matched, re-paint or re-coat the entire surface.

C. Quality:
1. In the sections of the product and execution of specifications which follow these general requirements, no concerted attempt has been made to describe each of the various existing products that must be used to patch, match, extend or replace existing work. Obtain such products in time to complete the work on schedule. Such products shall be provided in quality which is in no way inferior to the existing products.
2. The quality of the products that exist in the buildings, as apparent during pre-bid site visits, shall serve as the specification requirement for strength, appearance, and other characteristics.

D. Transitions:
1. Where new work abuts or finishes flush with existing work, make the transition as smooth and workmanlike as possible. Patched work shall match existing adjacent work in texture and appearance so as to make the patch or transition invisible to the eye.
2. Where masonry, or other finished surface is cut in such a way that a smooth transition with new work is not possible, terminate the existing surface in a neat fashion along a straight line at a natural line of division and provide trim appropriate to the finished surface.
3. Where two or more spaces are indicated to become one space, rework floors and ceilings so that horizontal planes, without breaks, steps or bulkheads result.
4. In cases of extreme change of level (3" or more), obtain instructions from Architect as to method of making transition. Either stepping, bulkheading, encasement, ramping, sloping or change of transition line shall be employed, or a combination of these, as directed in each case by the Architect.

E. Matching:
1. Restore existing work that is damaged during construction to a condition equal to its condition at the time of the start of the work.
2. At locations in existing areas where partitions are removed, patch the floors, walls, and ceilings with finish materials to match adjacent finishes.

3. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.6 REPAIR

A. Replace work damaged in the course of alterations, except at areas approved by the Architect for repair.

B. Where full removal of extensive amounts of almost-suitable work would be needed to replace damaged portions, then filling, spackling, straightening, and similar repair techniques, followed by full painting or other finishing, will be permitted.

C. If the repaired work is not brought up to the standard for new work, the Architect will direct that it be cut out and replaced with new work.

3.7 FIRESTOPPING

A. Where existing partitions or walls are penetrated by new work, seal around penetrating conduit or sleeve with approved and listed safing.

3.8 CLEANING

A. In addition to cleaning specified in SECTION 01 74 13 - PROGRESS CLEANING, clean Owner-occupied areas of work daily.

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 CODES

A. Where references are made on drawings or specifications to codes, they shall be considered an integral part of the contract documents as minimum standards. Nothing contained in the contract documents shall be so construed as to be in conflict with any law, bylaw or regulation of the municipal, state, federal or other authorities having jurisdiction.

B. Perform work in compliance with all City of North Richland Hills ordinances and requirements.

1.2 GOVERNING LAWS

A. Additional information with legal implications regarding applicable governing laws and jurisdictions can be found in the conditions of the contract.

1.3 PERMITTING

A. Contractor shall, without additional expense to Owner, obtain necessary licenses and permits, and be responsible for complying with any federal, state, county and municipal laws, codes and regulations applicable to the performance of the work, including, but not limited to, any laws or regulations requiring the use of licensed contractors to perform parts of the work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the contract documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the contract documents to the extent referenced. Such standards are made a part of the contract documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the contract documents.

C. Copies of Standards: Each entity engaged in construction on project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the contract documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	800.872.2253 202.272.0080
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterway Experiment Station http://www.erdc.usace.army.mil/	601.634.2355
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257
	Available from General Services Administration www.gsa.gov	202.501.1021
	Available from National Institute of Building Sciences www.nibs.org	202.289.7800
ICC-ES	ICC Evaluation Services, Inc. www.icc-es.org	800.423.6587 562.699.0543
MIL	See MILSPEC	
MIL-STD	See MILSPEC	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257

TAS	Texas Accessibility Standards P.O. Box 12157 Austin, TX 78711 www.license.state.tx.us/ab/abtas.htm	512.463.3211

1.2 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	703.358.2960
AAMA	American Architectural Manufacturers Association www.aamanet.org	847.303.5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	202.624.5800
ACI	ACI International (American Concrete Institute) www.aci-int.org (www.concrete.org)	248.848.3700
AGA	American Gas Association www.aga.org	202.824.7000
AISC	American Institute of Steel Construction www.aisc.org	800.644.2400 312.670.2400
AISI	American Iron and Steel Institute www.steel.org	202.452.7100
ANSI	American National Standards Institute www.ansi.org	202.293.8020
APA	APA-The Engineered Wood Association www.apawood.org	253.565.6600
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers www.ashrae.org	404.636.8400
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	610.832.9585
AWI	Architectural Woodwork Institute www.awinet.org	571.323.3636
AWPA	American Wood Protection Association www.awpa.com	205.733.4077
AWS	American Welding Society www.aws.org	800.443.9353 305.443.9353
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	212.297.2122
BIA	Brick Industry Association (The) www.gobrick.com	703.620.0010

CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	630.584.1919
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	301.596.2583
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	847.517.1200
DHI	Door and Hardware Institute www.dhi.org	703.222.2010
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	401.275.3000
GA	Gypsum Association www.gypsum.org	301.277.8686
GANA	Glass Association of North America www.glasswebsite.com	785.271.0208
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	703.435.2900
IGCC	Insulating Glass Certification Council www.igcc.org	315.646.2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	613.233.1510
MBMA	Metal Building Manufacturers Association www.mbma.com	216.241.7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	888.480.9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	312.644.6610
MIA	Marble Institute of America www.marble-institute.com	440.250.9222
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	630.942.6591
NCMA	National Concrete Masonry Association www.ncma.org	703.713.1900
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	207.829.6901
NEMA	National Electrical Manufacturers Association www.nema.org	703.841.3200

NFPA	NFPA (National Fire Protection Association) www.nfpa.org	800.344-3555 617.770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	301.589.1776
NHLA	National Hardwood Lumber Association www.nhla.com	800.933.0318 901.377.1818
NLGA	National Lumber Grades Authority www.nlga.org	604.524.2393
NOFMA	National Oak Flooring Manufacturers Association (The Wood Flooring Manufacturers Association) www.nofma.org	901.526.5016
NRCA	National Roofing Contractors Association www.nrca.net	800.323.9545 847.299.9070
NTMA	National Terrazzo & Mosaic Association, Inc. www.ntma.com	800.323.9736 540.751.0930
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	312.786.0300
PDCA	Painting and Decorating Contractors of America www.pdca.org	800.332.7322 314.514.7322
SDI	Steel Deck Institute www.sdi.org	847.458.4647
SDI	Steel Door Institute www.steeldoor.org	440.899.0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	516.294.5424
SGCC	Safety Glazing Certification Council www.sgcc.org	315.646.2234
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	843.626.1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	703.803.2980
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	850.434.2611
TCNA	Tile Council of America, Inc. www.tileusa.com	864.646.8453
TPI	Truss Plate Institute, Inc. www.tpinst.org	703.683.1010

UL	Underwriters Laboratories Inc. www.ul.com	800.285.4476 847.272.8800
USGBC	U.S. Green Building Council www.usgbc.org	800.795.1747 202.828.7422
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	800.283.1486 503.639.0651
WDMA	Window & Door Manufacturers Association (Formerly: NWWA - National Wood Window and Door Association) www.wdma.com	800.223.2301 312.321.6802
WI	Woodwork Institute www.woodworkinstitute.com	916.372.9943
WWPA	Western Wood Products Association www.wwpa.org	503.224.3930

B. Code Agencies: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

BOCA	BOCA International, Inc. (See ICC)	
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	909.472.4100
ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) www.iccsafe.org	888.422.7233 703.931.4533
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	800.638.2772 301.504.6816
EPA	Environmental Protection Agency www.epa.gov	202.272.0167
OSHA	Occupational Safety & Health Administration www.osha.gov	800.321.6742 202.693.1999

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 42 16

DEFINITIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. “Furnish": Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. "Install": Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

C. "Product": Materials, systems and equipment.

D. “Project Manual”: Volume assembled for the Work which may include the bidding requirements, sample forms, conditions of the contract, and specifications.

E. "Provide": Furnish and install, complete and ready for the intended use.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Quality control of products and workmanship.
2. Manufacturer's instructions.
3. Manufacturer's certificates and field services.
4. Mockups.

B. Related Requirements:
1. Section 01 33 23 - Shop Drawings, Product Data, and Samples: Field samples. Submittal of manufacturer's instructions.
2. Section 01 42 00 - References.
3. Section 01 45 23 - Testing and Inspection Services.
4. Section 01 62 00 - Product Options.
5. Individual Specifications Sections: Mockups required.

1.2 DESCRIPTION

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, workmanship, and site conditions, to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Provide suitably qualified personnel to produce work of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

D. Provide finishes to match approved samples.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Require compliance with instructions in full detail, including each step in sequence.

B. Should instruction conflict with contract documents, request clarification from Architect/Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specifications section, submit manufacturer's certificate, in duplicate, certifying that products meet or exceed specified requirements, executed by responsible officer.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specifications section, have manufacturer or his authorized representative provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment test, adjust, and balance of equipment as applicable, and to make written report of observations and recommendations to Architect.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 10 days of observation to Architect/Engineer for review.

1.7 MOCKUPS

A. Tests will be performed under provisions of SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. Assemble and erect complete, with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Acceptable mockups in place may be retained in completed work.

1.8 FIELD SAMPLES

A. Install field samples at the site as required by individual specification sections for review.

B. Acceptable samples represent a quality level for the work.

C. Where field sample is specified in individual sections to be removed, clear area after field sample has been accepted by Architect/Engineer.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTION SERVICES (BY OWNER)

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included: Owner provided materials testing laboratory services.

B. Related Requirements:
1. Document 00 31 32 - Geotechnical Data.
2. Terms and Conditions: Inspections, testing, and approvals required by public authorities.
3. Section 01 45 00 - Contract Quality Control: Manufacturer's certificates.
4. Section 01 78 39 - Project Record Documents.
5. Individual Specifications Sections: Inspections and tests required, and standards for testing.

1.2 SELECTION AND PAYMENT

A. Owner will employ services of an independent materials testing laboratory to perform specified inspection and testing and will pay for these services directly to the testing laboratory.

B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of contract documents. Contractor will pay all testing required by local authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Laboratory shall comply with requirements of ASTM E 329 and ASTM D 3740 and provide certifications to this effect.

B. Laboratory shall maintain a full-time registered Engineer on staff to review specific tests required by this specification.

C. Laboratory shall be authorized to operate in State in which project is located.

D. Testing equipment shall be calibrated to ensure accurate results and values in order to ensure that test results are true and valid, and at intervals with devices of an accuracy traceable to either NBS Standards or accepted values of natural physical constants.

1.4 LABORATORY RESPONSIBILITIES

A. Provide qualified personnel at site after due notice from the contractor; cooperate with Architect, Contractor, and appropriate public authorities having jurisdiction in performance of services.

B. Perform specified inspection, sampling, and testing of products in accordance with latest, up-to-date standards.

C. Ascertain compliance of materials and mixes with requirements of contract documents.

D. Promptly notify Architect, appropriate consultants, Contractor, Owner, and authority having jurisdiction of observed irregularities or non-conformance of work or products.

E. Perform additional inspections and tests required by Architect, Owner, Contractor, or authority having jurisdiction.

1.5 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Architect, one to applicable consultant, one to Owner, one to Contractor, and one to City. Include: Date issued, project title and number, name of inspector, date and time of sampling or inspection, weather conditions, identification of product and specifications section, location in the project, type of inspection or test, date of test, results of tests, and specific indication of conformance, or lack of such, with contract documents. When requested by Architect/Engineer, provide interpretation of test results.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of contract documents.

B. Laboratory may not approve or accept any portion of the work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop work.

1.7 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.

B. Cooperate with laboratory personnel, and ensure ready access to work and to manufacturer's facilities, if requested by testing lab.

C. Provide incidental labor and facilities for access to work to be tested, to obtain and handle samples at the site, or at source of products to be tested, in order to facilitate tests and inspections, and for storage and curing of test samples.

D. Notify laboratory of material sources and furnish lab-determined necessary quantities of representative samples of materials proposed for use which are required to be tested.

E. Notify Architect and laboratory 24 hours prior to expected time for operations requiring inspection and testing services. Cancel notifications in a timely manner if items or systems are not ready for inspection as intended. Reimburse Owner for trip charges when cancellation notifications are not made in a timely fashion.

F. Advise laboratory in a timely fashion to complete required inspection and testing prior to subsequent work being performed.

G. Reimburse Owner for all subsequent re-testing of products or systems found to be defective or otherwise not in accordance with specification requirements, and for any overtime pay required as a result of any inspection requirements that may fall outside of normal job-site weekday work schedule. Remove rejected products or work and replace with products or work of specified quality.

H. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and testing laboratory when the source of any material is changed after the original tests or inspections have been made.

PART 2 - PRODUCTS – Not used.

PART 3 - EXECUTION

3.1 EARTHWORK (SITE GENERAL)

A. Make necessary soil tests (Atterberg Limit Series ASTM D 4318 and ASTM D 698 Standard Proctor) to determine moisture content and density of existing subgrade. Perform necessary soil tests (Atterberg Limit Series and ASTM D 698 Standard Proctor for each type of imported fill) to determine the moisture content and to inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D 2922 and ASTM D 3017) per 5,000 sq. ft. of site area in the area affected on each lift prior to placement of additional fill material.

B. Imported Topsoil Tests: Testing for topsoil quality compliance shall be performed by the Testing Laboratory.

3.2 PAVING OR SPECIAL SURFACE SUBGRADE PREPARATION

A. Perform one subgrade in-place density test per 7,500 sq. ft. of subgrade, after subgrade preparation, in accordance with ASTM D 2922 and ASTM D 3017. Perform tests within 48 hours of pavement construction.

B. Pulverization tests on lime subgrade, TEX101E, Part III, at same frequency as density tests.

3.3 BUILDING SUBGRADE PREPARATION

A. Make necessary soil tests (Atterberg Limit Series and ASTM D 698 Standard Proctor for each type of fill) to determine the moisture content and density of existing subgrade and inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D 2922 and ASTM D 3017) for each 5,000 sq.ft. of area within the building footprint on each lift prior to placement of additional fill material.

3.4 DRILLED CONCRETE PIERS

A. The independent testing laboratory shall provide the services of their registered geotechnical engineer at the initiation of the on-site pier drilling operations to determine the appropriate bearing material into which the piers are to be founded. Written documentation of the "determination" shall be prepared and forwarded to the Owner, Architect, and Contractor.

B. Make on-site full-time inspections of the pier drilling operation for each pier drilled and placed to verify that the proper strata and penetration, or depth, has been attained, and determine that shafts are properly clean and dry before placing concrete.

C. Maintain a pier log for each pier showing design requirements and actual in place size and depth, in accordance with example noted in Specification SECTION 31 63 29 - DRILLED CONCRETE PIERS.

D. Verify that the excavation is of the proper size and adequately clean and dry.

E. Verify that each shaft is founded at a depth in accordance with the geotechnical report, existing on-site conditions that may be encountered, and at the proper bearing strata.

F. Verify that the reinforcing steel and concrete are properly placed in accordance with other testing provisions specified herein.

G. Notify the Architect and Contractor if soil or water conditions may require casing of piers.

H. Inspection reports of pier drilling shall contain the following:
1. Pier Mark.
2. Pier Depth.
3. Depth of penetration into bearing strata.
4. Plumbness deviation.
5. Description of unusual conditions encountered, including groundwater.
6. Record of deviations from contract document requirements.

7. Other requirements, as defined in SECTION 31 63 29 - DRILLED CONCRETE PIERS.

3.5 FORMWORK, REINFORCING STEEL AND INSERTS

A. Make general inspection of formwork.

B. Prior to each concrete pour, inspect fabrication and bending of bars, bar sizes, spacing, placement and tying in accordance with ACI 315.

C. Prior to each concrete pour, inspect positioning of steel inserts and assemblies, sizes, and spacing, and inspect fusion-welded anchors and sheer connectors.

3.6 CAST-IN-PLACE CONCRETE

A. Design Mixes:
1. At the beginning of the work, Contractor shall submit proposed concrete mixes for review by the Architect, structural engineering consultant, and testing laboratory, including the sieve analysis of fine and course aggregate ASTM C 136, dry rodded weight of coarse aggregate - ASTM C 29, and the specific gravity (bulk saturated surface dry), of fine and coarse aggregates ASTM C 127 and C 128.
2. The testing laboratory will submit their findings to the structural consultant, who will subsequently forward this information, with their review of the submittals, to the Architect.
3. Contractor shall not mix concrete for placing in the work until confirmation laboratory reports are supplied to reflect that each proposed mix will develop the strength required. Successful past history in accordance with ACI 318 will be satisfactory.

B. Test Cylinders: Make at least one test of each day's pouring of concrete or each 100 cubic yards, whichever is the least, on each different portion or section of the work. Mold and cure specimens in accordance with ASTM C 31, and test in accordance with ASTM C 39. Test cylinders shall be made and tested by the laboratory. Footings, walls, and floor systems constitute different sections. Each test shall consist of four specimens, one of which shall be broken at seven days, two at 28 days and one held in reserve. Determine temperature and air content for each set of test cylinders in accordance with ASTM C 231.

C. Field Quality Control:
1. Determine slump for each concrete strength test and whenever consistency of concrete varies, in accordance with ASTM C 143.
2. Monitor and record addition of water to concrete and length of time concrete is allowed to remain in truck.
3. Verify delivery tickets indicating class of concrete, amount of water added during initial batching, and time initial batching occurred.
4. Monitor work being performed in accordance with ACI (American Concrete Institute) recommendations as a standard of quality.
5. Reference SECTION 03 30 00 - CAST-IN-PLACE CONCRETE for additional requirements.

D. Source Quality Control: An independent testing laboratory representative shall periodically inspect and control concrete mixing and loading of transit mix trucks at batch plant at intervals appropriate to monitor quality of material issued on job.

3.7 MORTAR, GROUT, AND MASONRY REINFORCEMENT

A. Coordinate with Owner’s testing laboratory to provide periodic inspection of the following task:
1. As masonry construction begins, the following shall be verified to ensure compliance:
   a. Proportions of site prepared mortar.
   b. Construction of mortar joints.
   c. Location of reinforcement and connectors.
2. The inspection program shall verify:
   a. Size and location of structural elements.
   b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
   c. Specified size, grade, and type of reinforcement.
   d. Protection of masonry during cold weather (temperature below 40°F.) or hot weather (temperature above 90°F.).

3. Prior to grouting, the following shall be verified to ensure compliance:
   a. Grout space is clean.
   b. Placement of reinforcement and connectors.
   c. Proportions of site-prepared grout.
   d. Construction of mortar joints.

B. Coordinate with Owner's testing laboratory to provide continuous inspection of the following task:
   1. Grout placement shall be verified to ensure compliance with code and construction document provisions.

3.8 STRUCTURAL STEEL

A. Fabrication of, erection of, and connections between, structural steel members, including welding and tension in high strength bolts, will be accomplished under and subject to the inspection of an independent testing agency. The general contractor, structural steel fabricator, and erector shall afford full cooperation to the laboratory.

B. Perform the following testing and inspection: (Prior to placement of steel deck)
   1. Check location of condition of anchor bolts.
   2. Check plumbness and tolerance of steel frame.
   3. Qualification of welders and welding techniques (at Contractor's expense).
   4. Visually inspect common bolts.
   5. Inspection of high-strength bolting:
      a. Visually inspect connections.
      b. Check tightness of at least 33% of connections.
      c. Check at least two bolts of each girder to column connection.
   6. Visually inspect field and shop welds.
   7. Ultrasonic or X-ray testing of full penetration welds.
   8. Re-inspect corrective measures required at expense of Contractor.
   9. Verify that no members are damaged.
   10. Verify that materials and installation are according to contract documents and industry standards.

C. Gas Cutting: Do not use gas cutting torches for correcting fabrication errors in the structural framing. Cutting will not be permitted on any member, unless specifically approved by the structural engineer. Finish gas-cut sections equal to a sheared appearance when gas finish cutting is permitted. Do not flame cut holes or enlarge holes by burning.

D. Correction: The fabricator or erector shall correct deficiencies in structural steel work which inspection and test reports have indicated to be not in compliance with the specified requirements. Perform all additional tests required to reconfirm non-compliance of the original work and to show compliance of corrected work. Retesting of non-conforming work shall be paid by the Contractor.

E. All welders employed during erection of structural steel must be certified by The American Welding Society for type of base materials and positions encountered. Certification testing to be performed at Contractor's expense and copies of Certifications shall be submitted for review upon request and maintained at the project site by the Contractor.

3.9 STEEL JOISTS

A. All steel joists and connections to structural steel members shall be inspected.

B. Quality Assurance: All welding performed during the manufacture and erection of steel joists shall comply with the requirements of AWS D1.1.

C. Inspect condition of joists after erection; check method of attachment to structures and details of bridging and accessories to verify compliance with required standards.

3.10 METAL DECKING

A. Qualification of Welders: Qualify the welding process and all welders (at Contractor expense), and periodically monitor the work in accordance with the requirements of AWS D1.3.

B. Testing Laboratory shall inspect steel decking to ensure the material and installation is in accordance with the specifications and shop drawings.

3.11 METAL DECK AND FIELD WELDED SHEAR STUDS:

A. The erection of metal deck and field welded shear studs shall be subject to inspection by the testing agency.

B. Shear Studs:
1. Test minimum of two shear studs welded at start of each production period in order to determine generator, control unit and stud welder setting. Studs shall be capable of being bent 45° from vertical without weld failure. If, after welding, visual inspection reveals that sound weld or a full 360° fillet has not been attained for a particular stud, such stud shall be struck with hammer and bent 15° off perpendicular to nearest end of beam. Studs failing under this test shall be replaced.
2. When the temperature is below 32°F., two studs from each group of 100 studs (or one stud if less than 100 studs are present) should be tested after cooling. Studs shall not be welded below 0°F. or when surfaces are wet with rain or snow. If stud fails in weld, two new studs shall pass test before resumption of welding.

3.12 AIR BARRIER

A. Mock-up Testing: Perform preconstruction testing on field mock-ups. Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
3. Water Penetration Testing: Mockups will be tested for water penetration according to ASTM E 1105.
4. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D 4541 (modified).
   a. Use a type II pull tester, except that the membrane shall be cut through to separate the material attached to the disc from the surrounding material.
   b. Perform test after curing period recommended by the material manufacturer.
   c. Record mode of failure and area where the material failed in accordance with ASTM D4541.
   d. The inspection report shall indicate whether the specified adhesion requirement has been met.
5. Compatibility Determinations: Mockups will be inspected for visual signs of decay, chemical attack, or degradation of any kind. Suspect instances shall be reported to the corresponding manufacturer who shall provide a letter that approves moving forward with the project or rejects the use of the product or rejects the method or circumstances of installation with an appropriate explanation of the position taken.
6. Notify Architect seven days in advance of the dates and times when mockups will be tested.
7. Perform the air leakage test and water penetration test of mockups prior to installation of cladding and trim but after installation of all fasteners for cladding and trim, and after installation of other penetrating elements.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.

13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

C. Tests: As determined by Owner's testing agency from among the following tests:
1. Qualitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization or ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Quantitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 783.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

3.13 BUILT-UP BITUMINOUS ROOFING TESTING AND INSPECTION

A. Make periodic inspections while roofing installation is underway basing frequency on status of work being done and quality control problems being encountered.

B. Verify type of asphalt being used and temperature of asphalt at kettle and at point of discharge on the roof. Verify proper spreading.

C. Verify that type and manufacturer of roofing felts conforms with contract document requirements. Verify that felts have been properly stored and protected and are dry at time of installation.

D. Verify that type and manufacturer of insulation and installation conforms with contract document requirements. Verify proper storage of insulation and dryness at time of installation.

E. Verify status and conditions of metal deck prior to roof insulation installation.

F. Verify that installation of asphalt and roofing felts are according to the contract documents and roofing manufacturer's recommendations.

G. Inspect roofing installation prior to flood coating and mark and report fishmouths, felt-to-felt conditions and other departures from good roofing practices.

H. Verify that size, cleanliness and moisture content of aggregate is according to specifications.

I. Verify installation of flashings, water cut-offs and other methods to protect in-place roofing from the elements has been accomplished in accordance with contract document requirements.

J. Document the results of all inspection and tests and distribute copies to roofing contractor, roofing manufacturer, Contractor, Architect, and Owner.

K. Immediately notify all parties of those portions of tests or inspections which do not comply with contract document requirements.

3.14 CEMENTITIOUS FIREPROOFING

A. Application inspection to ensure the material and installation is in accordance with the specifications.

B. Sample and verify the thickness and density of spray applied fireproofing in accordance with ASTM E 605 for each days application.

3.15 SMOKE TEST OF DRAINAGE AND VENT PIPING

A. Test to check for joint leakage in the sanitary sewer system and vent system.

3.16 OTHER WORK REQUIRING TESTS

A. Refer to individual sections covered under Divisions 22, 23, and 26 for other work requiring tests by independent testing laboratory.

B. Other Tests:
   1. Moisture content in face brick.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL

A. Provide temporary facilities and controls needed for the work including, but not limited to those described in the Articles below.

B. Maintain temporary facilities and controls as long as needed for safe and proper completion of the work.

1.2 ACCESS

A. Provide adequate access to and temporary roads to the site of the building if required for the prosecution of the work.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Covered Walkway: Erect a structurally adequate, protective covered walkway for passage of persons entering and exiting building. Coordinate with entrance gates, other facilities and obstructions. Comply with regulations of authorities having jurisdiction.

1.3 FIELD OFFICE

A. Provide and maintain a weathertight temporary field office equipped with adequate illumination; with glazed operable windows; with smooth tables for perusal of drawings and specifications; and with metal legal size four-drawer filing cabinet. During cold weather the field offices shall be equipped with a heating device to maintain 65°F. temperature during the work day. During hot weather the offices shall be equipped with an air conditioning device to maintain temperature below 80°F. Provide and pay for fuel and electric energy. In addition to the above listed equipment, provide a space to accommodate the site meetings and have a layout/conference table at 28" height and chairs for 12 people. Upon completion of the project, remove offices from the premises.

1.4 TELEPHONES AND ELECTRONIC COMMUNICATION SERVICE

A. Provide telephones/mobile phones in the field office. Telephone shall be in operation from the commencement of work until the acceptance of the building. Contractor shall pay for installation, maintenance, and removal of telephones, lines and for all use charges.

B. Electronic Communication Service: Provide a computer, printer, high-speed data connection, and internet service as required for the Contractor to maintain internet access and e-mail correspondence.
   1. The Architect's project management system is Projectmates by Systemates, which can be accessed by logging in at the following website: www.vlkprojects.com. Contractor shall utilize this system for all formal and informal correspondence with the Architect and Architect's Consultants, including E-Mails, Requests for Information, Proposals, Submittals, Submittal Transmittals, Meeting Minutes (for regularly scheduled meetings), and Warranty Responses (if warranty items are submitted in the system). In addition, Subcontractor Lists, Project Schedules, Schedule of Values and other documents requiring submission shall be uploaded in pdf, Word, or Excel format by the Contractor to the appropriate location in Projectmates. At the Contractor's option, Pay Applications, Project Schedules, and Transmittals, may be created or imported into the system, as well.
   2. While the project management system is very user friendly and easy to learn, Architect will provide informal training for the Contractor as necessary to expedite the Contractor's familiarity with the program.
   3. Contractor shall pay for installation, maintenance, and removal of high-speed data connection and for all use charges.

1.5 TEMPORARY ELECTRICAL SERVICE

A. At all locations, the Contractor may utilize building electrical power to the extent existing power may be suitable for construction operations. The contractor shall make all tie-ins and shall maintain utility service in all occupied areas. Damage, if any, caused by the Contractor use or tie-ins shall be immediately corrected by the Contractor to as-new conditions. Owner shall pay only the energy charges.
1. Provide GFCI adapters since existing circuits may not be protected.

B. The contractor shall provide, install, and maintain separate temporary electrical service, including a separate temporary electric meter and temporary pole, if required. The contractor shall be responsible for contacting and coordinating with the local utility company for the installation, maintenance and removal of the temporary service. The contractor shall pay for all costs associated with this separate temporary electrical service.

1.6 TEMPORARY LIGHTING

A. Provide and maintain temporary lighting inside the building for safe and adequate working conditions throughout all areas where work of any kind is being performed. Provide at least 1/2 watt of incandescent lighting for each square foot of space. Where practical, place temporary lights in the locations where the permanent lighting fixtures are to be installed.

1.7 TEMPORARY HEAT

A. Provide necessary heat during the course of construction, including equipment, fuel and attendance where required. Equipment for temporary heating shall be of a non-smudging type. The permanent heating system may be used for temporary heat, when installed. Upon completion and before acceptance of the building, Contractor shall repair all damage caused by such temporary use and shall clean all filters.

B. When the outside temperature is below freezing, inside of the building shall be kept at or above 40°F. at all times. While painting and finishing are in progress, the temperature shall be kept at or above 60°F. Contractor shall make good all damage caused by insufficient heat.

1.8 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.9 TEMPORARY WATER SERVICE

A. Provide and maintain a temporary water supply during the course of construction and pay water bill and meter installation or "tap" fee, if any. Include necessary piping and hose connections. Take precautions to avoid spattering and spilling water in the building.

B. Provide and maintain a temporary water supply during the course of construction and pay meter installation or "tap" fee, if any. Include necessary piping and hose connections. Take precautions to avoid spattering and spilling water in the building. Monthly water usage will be paid by the Owner.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide and maintain adequate sanitary toilet facilities on the project site. The toilet facilities shall meet the requirements of the public authorities having jurisdiction and their use strictly enforced. Sanitary sewer "tap" fee and monthly use fees, if any, shall be paid by Contractor if temporary facilities are connected to city sanitary sewer.

1.11 REFUSE

A. The Contractor shall provide refuse removal service at all times.

1.12 PROTECTIVE FACILITIES

A. Provide and maintain temporary guardrails, handrails and covers for floor, roof and wall openings, vertical shafts and stairways. If movement of the protective facilities is required by a subcontractor to perform his work, it will be the responsibility of that subcontractor to give prior notification to the Contractor and to replace the protective facilities in a satisfactory manner.

B. Provide and maintain, as per City of North Richland Hills requirements, fire lane(s) and other required fire protection at the appropriate time and sequence of construction.

1.13 BARRICADES

A. Provide and maintain lighted barricades and fences for the public protection in accordance with requirements of the local city ordinances.

1.14 TEMPORARY FENCING

A. Provide and maintain for the duration of construction a temporary fence of design and type needed to prevent entry onto the work by the public.

1.15 TEMPORARY FIRE PROTECTION

A. Contractor shall provide adequate fire extinguishers on the premises during the course of construction, of the type and size recommended to control fires, which may result from the particular work being performed in accordance with the local fire marshal and fire codes.

B. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of ignition for possible fires.
   1. Keep work area free of combustible material.
   2. A fire watch consisting of at least one man furnished by Contractor with a fire extinguisher in hand and with no other assigned duties, shall be posted to stand by and observe for potential hazards while welding or cutting is being done. Equip fire watch with suitable personal eye protection and fire extinguishers.
   3. At completion of work operations, immediately inspect work and adjacent area for hazards. Re-inspect work for hazards at 1/2 hour and at one hour after completion of welding and cutting operations.

C. No smoking shall be allowed within the building or on the site. Post NO SMOKING signs in areas where work is in progress.

1.16 ENCLOSURES

A. Provide temporary weathertight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, to allow for temporary heating, and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

B. Provide temporary partitions and ceilings as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, to prevent damage to existing areas and equipment. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces; STC rating 35 in accordance with ASTM E 90; flame spread rating of 25 in accordance with ASTM E 84; paint surfaces exposed to view in Owner occupied areas.

1.17 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment.

B. Protect site from puddling or running water.

1.18 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off site.

B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

C. Refer to SECTION 01 74 13 - PROGRESS CLEANING for additional cleaning requirements.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary materials, equipment, services, and construction prior to substantial completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2'; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

1.20 PROJECT IDENTIFICATION SIGNS

A. Furnish and erect a project sign, approximately 4' high by 8' long of 3/4" thick exterior grade plywood, in conformance with sign detail supplied by the Architect. Support on posts of framing of treated wood or steel.

B. Erect sign within 30 days of start of construction and maintain in good condition until completion of project. Sign shall be located as directed by the Architect.

C. No other signs or advertising of any kind, except precautionary warning signs, will be permitted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Storm Water Pollution Prevention and Pollution Control Plan as required by the Texas Commission on Environmental Quality (TCEQ), effective March 2018.

B. Related Sections:
Section 31 00 00 - Earthwork

1.02 QUALITY ASSURANCE

A. State Standards: Execution of the Pollution Prevention and the Pollution Control Plan shall meet all requirements set forth by TCEQ under the Texas Pollution Discharge Elimination System (TPDES) regulations.

PART 2 - PRODUCTS

NOT APPLICABLE.

PART 3 - EXECUTION

3.01 PERFORMANCE

A. General: Implement all the requirements detailed in the Erosion Control Plan and any additional pollution prevention and control measures required by the TCEQ.

B. The Erosion Control Plan is included as part of the construction plans. The erosion control measures shown on the plans are the minimum required for this project. The contractor shall implement additional erosion control devices as construction sequence and activities dictate.

C. The SWPPP document (including N.O.I. and N.O.T.) that makes up the balance of the SWPPP shall be prepared by the contractor at his expense. The contractor shall be the Owner/Operator of the SWPPP and responsible for executing and filing the N.O.I. and N.O.T. and paying all fees required by TCEQ.

END OF SECTION

SECTION 01 62 00

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for product options and substitutions.

B. Related Requirements:
1. Section 01 31 00 - Project Management and Coordination: Coordination of construction.
2. Section 01 33 23 - Shop Drawings, Product Data, and Samples: Product data submittals.
3. Section 01 42 00 - References: Applicability of specified reference standards.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Section 01 78 39 - Project Record Documents.

1.2 PRODUCT LIST

A. Within 30 days after date of contract, submit to the Architect a list of products and materials which are proposed for substitution per SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 CONTRACTOR'S OPTIONS

A. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

B. For products specified by naming several products or manufacturers, followed by the words "NO SUBSTITUTIONS", select one of the products/manufacturers named.

C. For products specified by naming only one product and manufacturer, there is no option unless a substitution is approved as specified below.

D. For products specified by naming only one product and manufacturer, followed by the words "NO SUBSTITUTIONS", there is no option.

1.4 SUBSTITUTIONS

A. Requests for substitution to material, products, or equipment instead of those specified will be considered if received at least 10 days prior to the bid date. Substitution request received within 10 days of the bid date will be returned without review. Refer to Substitution Request (During the Bidding Phase) form attached to this section.

B. Within 30 days after Notice to Proceed, Architect will consider additional formal requests from the Contractor for substitutions of products in place of those specified. Refer to Substitution Request (After the Bidding Phase) form attached to this section.

C. Submit a separate request for each substitution on a copy of the "SUBSTITUTION REQUEST" form, attached to this section. Include in request:
1. Complete data substantiating compliance of proposed substitution with contract documents.
2. For products:
   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature, including product description, performance and test data and reference standards.
   c. Samples, if applicable.
   d. Name and address of similar projects on which product was used and date of installation.
3. For construction methods:
   a. Detailed written descriptions of proposed method.
   b. Complete drawings illustrating methods or revisions.
4. Itemized Comparison of qualities of proposed substitution with product or method specified.
5. Changes required in other elements of work because of substitution.
6. Effect on construction schedule.

D. Request for substitution constitutes a representation that General Contractor or Construction Manager:
   1. Has personally investigated proposed product or method and determined that it is equal to or superior in all respects to that specified.
   2. Will provide same warranties for substitution as for product or method specified.
   3. Will coordinate installation of accepted substitution into the work, making such changes as may be required for the work to be complete in all respects.
   4. Waives all claims for additional cost, under his responsibility and related to substitution, which subsequently become apparent.

E. Substitutions will not be considered if:
   1. They are indicated or implied on shop drawings or product data submittals without formal request submitted in accordance with this section.
   2. Acceptance will require substantial revision of contract documents.

F. If substitution is not approved or accepted, Contractor shall furnish specified product or method at no additional cost to the Owner.

G. Acceptance of a proposed substitution prior to the bid date will be in the form of an addendum.

1.5 SUBMITTAL PROCEDURES

A. Submit request for substitution.

B. Architect will review Contractor's requests for substitutions with reasonable promptness.

C. For accepted products, submit shop drawings, product data, and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SUBSTITUTION REQUEST
(During the Bidding Phase)
(Submittal must be received 10 days prior to bid/proposal date)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, custom color/pre-selected color availability, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E/ design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E REVIEW AND ACTION

☐ Substitution approved - Submit bid/proposal based on accepted substitution.

☐ Substitution approved as noted - Submit bid/proposal based on accepted substitution - as noted.

☐ Substitution rejected - Submit bid/proposal for specified materials.

☐ Substitution Request received too late - Submit bid/proposal for specified materials.

Signed by: _____ Date: _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST
(After the Bidding Phase)
(Submittal must be received not later than 30 days after Notice to Proceed)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section No.: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

For finish materials and pre-finished equipment, list the colors available for the specified item and the colors available for the proposed substitution.

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST - Continued

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Section 01 33 23.

☐ Substitution approved as noted - Make submittals in accordance with Section 01 33 23.

☐ Substitution rejected - Use specified materials.

☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐_____

_____

_____

_____

_____

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SECTION 01 65 00

PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
1. Packaging, Transportation.
2. Delivery and Receiving.
3. Product Handling.

B. Related Requirements:
1. Section 01 32 16 - Construction Progress Schedules.
2. Section 01 33 23 - Shop Drawings, Product Data and Samples: Manufacturers' Instructions.
3. Section 01 66 00 - Product Storage and Handling Requirements.
4. Individual Sections: Specific requirements for packaging, shipping and handling.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PACKAGING, TRANSPORTATION

A. Require supplier to package products in boxes or crates for protection during shipment, handling and storage. Protect sensitive products against exposure to elements and moisture.

B. Protect sensitive equipment and finishes against impact, abrasion and other damage.

3.2 DELIVERY AND RECEIVING

A. Arrange deliveries of products in accordance with construction progress schedules. Allow time for inspection prior to installation.

B. Coordinate deliveries to avoid conflict with work and conditions at site; limitations on storage space; availability of personnel and handling equipment; and Owner's use of premises.

C. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.

D. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.

E. Immediately on delivery, inspect shipment to assure
1. Product complies with requirements of contract documents and reviewed submittals.
2. Quantities are correct.
3. Accessories, and installation hardware are correct.
4. Containers and packages are intact and labels legible.
5. Products are protected and undamaged.

3.3 PRODUCT HANDLING

A. Provide equipment and personnel to handle products by methods to prevent soiling and damage.

B. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging and surrounding surfaces.

C. Handle product by methods to avoid bending or over-stressing. Lift large and heavy components only at designated lift points.

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
   1. Storage, General.
   2. Enclosed Storage.
   3. Exterior Storage.
   4. Maintenance of Storage.

B. Related Requirements:
   1. Section 01 11 00 - Summary of Work.
   2. Section 01 50 00 - Construction Facilities and Temporary Controls: Storage facilities. Protection of installed work.
   3. Section 01 65 00 - Product Delivery Requirements.
   4. Section 01 78 39 - Project Record Documents.

PART 2 - PRODUCTS - Not used.

PART 3 - EXECUTION

3.1 STORAGE, GENERAL

A. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

B. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3.2 ENCLOSED STORAGE

A. Store products, subject to damage by the elements, in substantial weathertight enclosures.

B. Maintain temperature and humidity within ranges stated in manufacturer's instructions.

C. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.

D. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

3.3 EXTERIOR STORAGE

A. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.

B. For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.

C. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

D. Provide surface drainage to prevent erosion and ponding of water.

E. Prevent mixing of refuse or chemically injurious materials or liquids.

3.4 MAINTENANCE OF STORAGE

A. Periodically inspect stored products on a scheduled basis.

B. Verify that storage facilities comply with manufacturer's product storage requirements.

C. Verify that manufacturer required environmental conditions are maintained continually.

D. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of contract documents.

3.5 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions shown on exterior of package.

B. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a record document.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements and limitations for cutting and patching of work.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Work by Owner or by separate contractors.
2. Section 01 62 00 - Product Options.
3. Individual Specifications Sections:
a. Cutting and patching incidental to work of the section.
b. Advance notification to other Sections of openings required in work of those sections.
c. Limitations on cutting structural members.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit written request in advance of cutting or alteration which affects
1. Structural integrity of any element of the project.
2. Integrity of weather-exposed or moisture-resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

C. Include in request
1. Identification of project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time work will be executed.

1.3 PAYMENT FOR COSTS

A. Costs resulting from ill-timed or defective work, or work not conforming to contract documents, including costs for additional services of Architect or other consultants, shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products: Those required for original installation.

B. For any change in materials, submit request for substitution under provisions of SECTION 01 62 00 - PRODUCT OPTIONS.

PART 3 - EXECUTION

3.1 GENERAL

A. Execute cutting, fitting and patching including excavation and fill, to complete work, and to
1. Fit the several parts together, to integrate with other work.
2. Uncover work to install ill-timed work.
3. Remove and replace defective and non-conforming work.

4. Remove samples of installed work for testing.
5. Provide openings in elements of work for penetrations of mechanical and electrical work.

3.2 INSPECTION

A. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

B. After uncovering, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.3 PREPARATION

A. Provide temporary supports to assure structural integrity of surroundings; devices and methods to protect other portions of project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

C. Maintain excavations free of water.

3.4 PERFORMANCE

A. Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

B. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Restore work with new products in accordance with requirements of contract documents.

E. Fit work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated packing material, full thickness of the construction element.

G. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

END OF SECTION

SECTION 01 74 13

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this section.

B. Related Requirements: In addition to standards described in this section, comply with requirements for cleaning as described in other pertinent sections of these specifications.

1.2 QUALITY ASSURANCE

A. Conduct a daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris waste material, and other items not required for construction of the work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.
4. Provide adequate storage for all items awaiting removal from the project site, observing requirements for fire protection and protection of the ecology.

B. Site:
1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of this section.
3. Maintain the site in a neat and orderly condition at all times.

C. Structure:
1. Weekly, and more often if necessary, inspect the structure and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a hand-held broom.
3. As required preparatory to installation of succeeding materials, clean the structure or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

4. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials are installed.

D. "Clean", for the purpose of this subparagraph shall be interpreted as meaning free from foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

3.2 FINAL CLEANING

A. "Clean", for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provide by skilled cleaners using commercial quality building maintenance equipment and materials.

B. Prior to completion of the work, remove from the project site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in this section.

C. Site:
1. Unless otherwise specifically directed by Architect, broom clean paved areas on the site and public paved areas adjacent to the site.
2. Completely remove resultant debris.

D. Structure:
1. Exterior:
a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed materials from adjacent surfaces.
c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
d. In event of stubborn stains not removable with water, Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
2. Interior:
a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed material from adjacent surfaces.
c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
3. Glass: Clean inside and outside.
4. Polished Surfaces: To surfaces requiring routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. This does not apply to resilient flooring surfaces. Reference SECTION 09 65 00 - RESILIENT FLOORING for cleaning of resilient flooring.

E. Special floor/base final cleaning requirements:
1. Contractor shall coordinate with the Owner’s housekeeping department for preparing the surfaces for final cleaning by the Contractor and protective coatings installed by the Owner.
2. Protection after final treatment until date of Substantial Completion shall be the responsibility of the Contractor.
3. All repairs or re-application required as a result of damage caused by the Work shall be the responsibility of the Contractor as directed by the Owner.

F. Schedule final cleaning, as approved by the Architect, to enable the Owner to accept a completely clean work.

3.3 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the work, or any portion thereof, prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract for Construction.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance data submittal, including training sessions for equipment and systems.
   4. Submittal of warranties.
   5. Submittal of spare parts and maintenance materials.

B. Related Requirements:
   1. Section 01 11 00 - Summary of Work: record drawings.
   2. Section 01 21 00 - Allowances: allowance for indexed electronic archiving of closeout documents.
   3. Section 01 33 23 - Shop Drawings, Product Data and Samples.
   4. Section 01 74 13 - Progress Cleaning: final cleaning.
   5. Section 08 71 00 - Door Hardware: keys and keying schedule.

1.2 SUBSTANTIAL COMPLETION

A. General: Substantial Completion is defined in Paragraph 9.8.1 of the General Conditions.

B. Preliminary Procedures: Before requesting inspection for certification of substantial completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      a. If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete construction and reasons the work is not complete.
   2. Advise Owner of pending insurance change-over requirements.
   3. Submit specific warranties, maintenance agreements, final certifications and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   5. Submit record drawings, maintenance manuals and similar final record information.
   6. Deliver tools, spare parts, extra stock and similar items.
   7. Make final change-over of permanent locks and transmit keys and keying schedule to the Owner. Advise the Owner's personnel of change-over in security provisions.
   8. Complete start-up testing of systems, and training sessions for Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups and similar elements.
   9. Complete final clean-up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfulfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. Architect will repeat the inspection when requested and assured that the work has been substantially completed.

D. Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, submit the following. List exceptions in the request.
   1. Final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   2. Updated final statement, accounting for final additional changes to the contract sum.
   3. Certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
   4. Consent of surety to final payment.
   5. Final Liquidated Damages settlement statement.
   6. Evidence of final, continuing insurance coverage complying with insurance requirements.
   7. Evidence of Compliance with Requirements of Governing Authorities
      a. Certificate of Occupancy.
      b. Certificates of Inspection required for mechanical and electrical systems.
   8. Operation and Maintenance Data: Under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.
   9. Warranties and Bonds: Under provisions of SECTION 01 78 30 - WARRANTIES AND BONDS.
   10. Project Record Documents: Under provisions of SECTION 01 78 39 - PROJECT RECORD DOCUMENTS.
   11. Spare Parts and Maintenance Materials: Under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES AND MAINTENANCE MATERIALS.
   12. Keys and Keying Schedule: Under provisions of SECTION 08 71 00 - DOOR HARDWARE.
   13. Evidence of Payment and Release of Liens: In accordance with General Conditions of the Contract for Construction.
   14. Evidence of Payment of Debts and Claims: In accordance with General Conditions of the Contract for Construction.
   15. Certificate of Project Compliance: Required under provisions of Texas Administrative Code (TAC), Chapter 61, 1036(c)(3)(F). Form developed by the Texas Education Agency (TEA). See form attached to the end of this Section.
   16. Certification of Asbestos and Lead Free Project: The Contractor shall submit to the Architect a letter addressed to the Owner certifying that no materials used in the construction of this project contain lead nor asbestos materials in excess of amounts allowed by local/state standards, laws, codes, rules and regulations, Federal Environmental Protection Agency (EPA) standards and the Federal Occupational Safety and Health Administration (OSHA) standards, whichever are most restrictive. Certification shall further state that should lead or asbestos fibers be found in this project in concentrations greater than the allowed amounts, that the Contractor shall be responsible for determining which materials contain the lead or asbestos fibers and shall take corrective action to remove those materials from the project at no additional cost to the Owner. Final payment shall not be made until this letter of certification has been received.
   17. Indexed electronic closeout document archive by Delta-T Digital Archiving, per Allowance.

B. Re-inspection Procedures: Architect will re-inspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been complete, except items whose completion has been delayed because of circumstances acceptable to the Architect.
   1. Upon completion of re-inspection, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, re-inspection will be repeated.

C. Re-inspection Fees: Should status of completion of work require re-inspection by Architect due to failure of work to comply with Contractor's claims on initial inspection, Owner will deduct the amount of Architect and appropriate consultants compensation for re-inspection services from final payment to Contractor. The reimbursement transaction shall be executed by change order to the contract.

1.4 CLOSEOUT PROCEDURES

A. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in three individual heavy-duty 3-1/2", three-ring vinyl-covered binders, with identification on front and spine of each binder. Include the following types of information:
   1. Emergency instructions.
   2. Spare parts list.
   3. Copies of warranties.
   4. Wiring diagrams.

5. Recommended "turn around" cycles.
6. Inspection procedures.
7. Shop drawings.
8. Fixture lamping schedule.

B. Shop Drawings: Keep and maintain a full set of submittals throughout the construction phase to be submitted to the Architect with other close-out documents for delivery to the Owner for his permanent record. Set of submittals shall be delivered to the Architect in cardboard file boxes with string and button type closures. Organize submittals by CSI divisions, utilizing neatly labeled pressboard dividers to separate the sections. Neatly label short end of box with project name, contents and duration of construction.

C. Operating and Maintenance Training Sessions: Prepare a written agenda of items to be covered at each training session. Attendance by Owner's operating and maintenance personnel is mandatory. Notify Owner not less than 48 hours prior to scheduled training sessions.
   1. Arrange for each installer of equipment and systems that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
      a. Maintenance manuals.
      b. Record documents.
      c. Spare parts and materials.
      d. Tools.
      e. Lubricants.
      f. Fuels.
      g. Identification systems.
      h. Control sequences.
      i. Hazards.
      j. Cleaning.
      k. Warranties and bonds.
      l. Maintenance agreements and similar continuing commitments.
   2. Training sessions shall consist of not less than five days of not less than four hours each day. A copy of maintenance manuals for equipment or system being demonstrated shall be on hand during training session. As part of instruction for operating equipment, demonstrate the following procedures:
      a. Start-up.
      b. Shutdown.
      c. Emergency operations.
      d. Noise and vibration adjustments.
      e. Safety procedures.
      f. Economy and efficiency adjustments.
      g. Effective energy utilization.
   3. Training sessions shall be conducted for:
      a. HVAC systems.
      b. Energy management controls.
      c. Public address system.
      d. Fire alarm and smoke detection systems.
   4. Demonstration and Training DVDs
      a. General: Engage a qualified commercial photographer to record demonstration and training DVDs. Record each training session separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids.
      b. Digital Format: Provide high-quality DVD color recording.
      c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
      d. Narration: Describe scenes by audio narration by microphone while being recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
      e. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from recording opposite the corresponding narration segment.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Format and content of manuals.
2. Instruction of Owner's personnel.
3. Schedule of submittals.

B. Related Requirements:
1. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
2. Section 01 45 00 - Quality Control: Manufacturer's instructions.
3. Section 01 77 00 - Closeout Procedures.
4. Section 01 78 30 - Warranties and Bonds.
5. Section 01 78 39 - Project Record Documents.
6. Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.2 QUALITY ASSURANCE

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.3 FORMAT

A. Prepare data in the form of an instructional manual.

B. Binders: Bind in three individual heavy-duty 8-1/2" x 11" black, three-ring binders with hardback, cleanable, plastic covers; 3" maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; list title of project identify subject matter of contents.

D. Arrange content by systems, under section numbers and sequence of table of contents of this project manual.

E. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 20-pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of project; names, addresses, and telephone numbers of Architect/Engineer and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use project record documents as maintenance drawings.

E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in SECTION 01 45 00 - QUALITY CONTROL.

F. Warranties and Bonds: Bind in copy of each.

1.5 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in individual specifications sections.

E. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.6 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.

C. Include as-installed color coded wiring diagrams.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide as-installed control diagrams by controls manufacturer.

K. Provide Contractor's coordination drawings, with as-installed color coded piping diagrams.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual specifications sections.

O. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.7 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

1.8 SUBMITTALS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.

D. Submit two copies of revised volumes of data in final form within 10 days after final inspection.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 78 30

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation and submittal of warranties and bonds.
2. Schedule of submittals.

B. Related Requirements:
1. Document 00 21 16 - Instructions to Proposers: Proposer bonds.
2. General Conditions of the Contract for Construction: Performance Bond and Labor and Material Payment Bonds, Warranty, and Correction of Work.
3. Section 01 77 00 - Closeout Procedures.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Section 01 78 39 - Project Record Documents.
6. Individual Specifications Sections: Warranties and bonds required for specific products or work.

1.2 FORM OF SUBMITTALS

A. Bind in three individual heavy-duty 8-1/2" x 11" black, three-ring binders, with hardback, cleanable, plastic covers.

B. Label cover of each binder with typed or printed title WARRANTIES AND BONDS, with title of project; name, address and telephone number of Contractor; and name of responsible principal.

C. Table of Contents: Neatly typed, in the sequence of the table of contents of the project manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

D. Separate each warranty or bond with index tab sheets keyed to the table of contents listing. Provide full information, using separate typed sheets as necessary. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.3 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the date of substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.4 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

B. Make other submittals within 10 days after date of substantial completion, prior to final application for payment.

C. For items of work when acceptance is delayed beyond date of substantial completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Maintenance and submittal of record documents and samples.

B. Related Requirements:
1. General Conditions of the Contract for Construction: Documents at the site.
2. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
3. Section 01 77 00 - Closeout Procedures.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:
1. Contract drawings.
2. Specifications.
3. Addenda.
4. Change orders and other modifications to the contract.
5. Reviewed shop drawings, product data, and samples.
6. Field test records.
7. Inspection certificates.
8. Manufacturer's certificates.

B. Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage for record documents and samples.

C. Label and file record documents and samples in accordance with section number listings in table of contents of this project manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

D. Maintain record documents in a clean, dry and legible condition. Do not use record documents for construction purposes.

E. Keep record documents and samples available for inspection by Architect.

1.3 RECORDING

A. Record information on a set of opaque drawings, and in a copy of a project manual. All changes made in these drawings in connection with the final construction and installation shall be neatly made in red ink on the prints.

B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.

C. Contractor shall include with the record documents, all changes and modifications made by addenda, change orders, supplementary instructions, or other forms of documentation, written or verbal, which alter the documents.

D. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

E. Contract drawings and shop drawings: Legibly mark each item on the drawings to record actual construction, including:
1. Measured depths of elements of foundation in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.

4. Field changes of dimension and detail.
5. Changes made by addenda and modifications.
6. Details not on original contract drawings.
7. References to related shop drawings and modifications.

F. Specifications: Legibly mark each item in the specifications to record actual construction, including:
1. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
2. Changes made by addenda and modifications.

G. Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records, and other documents required by individual specifications sections.

H. Maintain these documents to reflect the current conditions of the work. Changes shall be reviewed on a monthly basis with the Architect's representative. The Contractor's updating of the "installed condition drawings" shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

1.4 SUBMITTALS

A. At contract closeout, deliver record documents and samples under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Transmit with cover letter in duplicate, listing:
1. Date.
2. Project title and number.
3. Contractor's name, address, and telephone number.
4. Number and title of each record document.
5. Signature of Contractor or authorized representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 40

SPARE PARTS, OVERAGES AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Includes:
   1. Products required.
   2. Storage and delivery of products.

B. Related Requirements:
   1. Section 01 66 00 - Product Storage and Handling Requirements.
   2. Section 01 77 00 - Closeout Procedures.
   3. Section 01 78 23 - Operation and Maintenance Data.
   4. Individual Specifications Sections: Specific spare parts and materials required.

1.2 PRODUCTS REQUIRED

A. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual sections to be provided to Owner, in addition to that required for completion of work.

B. Products: Identical to those installed in the work. Include quantities in original purchase from manufacturer to avoid variations in manufacture.

1.3 STORAGE, MAINTENANCE

A. Store products with products to be installed in the work, under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. When adequate, secure storage facilities are available at site, capable of maintaining conditions required for storage and not required for contract work or storage, or for Owner's needs, spare products may be stored in available space.

C. Maintain spare products in original containers with labels intact and legible, until delivery to Owner.

1.4 DELIVERY

A. Coordinate with Owner: Deliver and unload spare products to Owner at project site and obtain receipt prior to final payment.

B. For portions of project accepted and occupied by Owner prior to substantial completion, deliver a proportional part of spare products to Owner; obtain receipt.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Taking down, cutting away, breaking out and removing portions of the existing building to accommodate new construction.
2. Disconnecting, capping and removing identified utilities.
3. Offsite disposal and/or salvaging for reinstallation, indicated components.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Instructions concerning hazardous materials.
2. Section 01 35 00 - Alteration Project Procedures: Re-installation of removed materials.
3. Section 01 50 00 - Temporary Facilities and Controls: Barricades; Dust control.
4. Section 01 78 39 - Project Record Documents.

1.2 SUBMITTALS

A. Submit demolition and removal procedures and schedule under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Submit record documents under provisions of SECTION 01 78 39 - PROJECT RECORD DOCUMENTS. Accurately record actual locations of capped utilities and subsurface obstructions.

1.3 PROJECT CONDITIONS

A. Occupancy: Owner will be continuously occupying portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's operations.

B. Existing Conditions: Owner assumes no responsibility for actual condition of items or structures to be demolished. Contractor shall visit the building and verify the nature and extent of demolition required. Conditions existing at time of commencement of contract will be maintained by Owner insofar as practicable. However, variations within structures may occur by Owner's removal and salvage operations prior to start of selective demolition.

C. Property Protection: Contractor shall be responsible for the protection of adjoining property, including all parts of the building outside the limits of demolition and site improvements outside the limits of the new construction.

1.4 EXISTING CONDITIONS

A. Conduct demolition to minimize interference with adjacent portion of structures to remain.

B. Conduct operations with minimum interference with Owner's usage of building. Maintain protected egress and access at all times and maintain protected egress at fire exits as required by the Fire Marshall.

1.5 PROTECTION

A. It is essential that there be minimal interruptions of existing mechanical and electrical systems in addition to the normal operation of Owner's facilities.

B. Take care to ensure that there will be no damage to elements or portions thereof which are not required to be removed. Erect and maintain temporary shoring, bracing, and other means to safeguard the structural integrity of the existing portions of building and its parts to remain.

C. Erect and maintain temporary bracing, shoring, lights, barricades, signs and other means to protect workers and other persons, and finishes and improvements to remain from damage; all in accordance with applicable regulatory requirements.

D. Erect and maintain temporary barriers to confine dust and debris.

E. Protect existing trees to remain. Keep area within the drip line clear of construction traffic, parking, soil contamination, soil stockpiling, storage of materials, debris and ponding water.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials designated for demolition shall become the Contractor's property; remove and dispose of such materials unless otherwise indicated or specified. Sales of salvage materials are not allowed on site.

B. Furnishings and equipment items to remain the Owner's property will be removed by him prior to the start of demolition (or will be designated on the drawings herein or to be removed and stored by Contractor). Items not so designated shall be considered debris and shall be removed and disposed of accordingly.

C. Carefully disconnect, remove and protect items directed by the Owner to be salvaged.

D. Transport salvaged items to on-site storage areas designated by the Owner.

PART 3 - EXECUTION

3.1 INSPECTIONS

A. Prior to starting demolition, make inspection and report observable defects and structural weaknesses of construction designated for demolition, of adjacent structures, and of improvements to remain. If unsatisfactory conditions exist, do not commence demolition until appropriate determinations have been made.

B. Following demolition, make inspection and report defects and structural weaknesses of items partially demolished, cut, or removed, of adjacent structures; and of improvements remaining.

3.2 PREPARATION

A. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

B. Prevent movement or settlement of adjacent structures. Provide bracing, shoring and underpinning as required.

C. Protect existing appurtenances, structures and landscaping which are not to be demolished.

D. Locate, disconnect, remove and cap designated utility lines within demolition areas.

E. Mark location of disconnected utilities. Identify utilities and indicate capping locations on project record documents.

F. Provide weatherproof closures for exterior openings resulting from demolition work.

3.3 PERFORMANCE

A. Demolition: Carry out the work carefully and in an orderly manner to minimize interference with the daily operations in the building and to avoid damage to permanent parts of the building and the equipment therein. Hold noise, dust and vibration to a minimum. Remove all items and parts so shown and noted on the drawings and as otherwise may be required to be removed to carry out the work.

B. Shoring: Provide temporary shoring for walls and framing wherever present supports are removed or weakened. Any settling or cracking of the existing construction due to the removal of supports and faulty or insufficient shoring shall be the responsibility of the contractor and shall be repaired at no additional expense to the Owner.

C. Material and Equipment Disposal:
   1. The materials and items of equipment which are noted and shown to be salvaged and re-used in new locations or re-used for patching shall be carefully removed and safely stored until ready for reinstallation.
   2. Other items and all debris shall become the property of the Contractor and shall be removed from the premises entirely. Under no circumstances shall debris be allowed to accumulate.

D. Damage: Any existing construction to be left in place which is damaged by the demolition operations shall be refinished or replaced at no additional expense to the Owner. The repair of such damage shall leave the parts in a condition at least equal to that found at the start of the work.

E. Perform demolition in accordance with ANSI A10 - Construction and Demolition Standards, ANSI A10.6 – Safety and Health Program Requirements for Demolition Operations, and applicable regulatory requirements.

F. Remove items designated for demolition within the limits of work indicated and as required to perform the work. Do not remove anything beyond the limits of demolition indicated without the prior written approval of Architect. If in doubt whether to remove an item, obtain written approval prior to proceeding.

G. If in the event hazardous materials (asbestos, PCB's etc.) are encountered during the course of the demolition work, or if it is even suspected that such materials will or have been encountered cease work immediately in the affected area and promptly notify the Owner and Architect.

3.4 CUTTING

A. Make new openings neat, as close as possible to profiles indicated and only to extent necessary for new work.

B. Do not cut or alter structural members unless specifically indicated or approved, and do not damage reinforcing or structural steel to remain.

C. At concrete, masonry, paving and other materials where edges of cuts and holes will remain exposed in the completed work, make cuts using power-sawing and -coring equipment. Do not over-cut at corners of cut openings.

D. Upon completion of cutting and coring, clean remaining surfaces of loose particles and dust.

3.5 PIPES, DUCTS AND CONDUITS

A. Remove deactivated mechanical, plumbing and sprinkler piping, ducts and electrical conduit, including fastenings, connections and other related appurtenances and accessories which would otherwise be exposed in the completed work or interfere with construction operations.

B. These facilities above ceilings may remain in place if their presence does not result in interference with new work, in which case they shall be removed to extent necessary.

C. Cap deactivated piping systems at points of cutoff.

3.6 RECONDITIONING EXISTING SUBSTRATES

A. Clean surfaces on which new materials will be applied, removing adhesives, bitumen and other adhering materials, as necessary to furnish acceptable substrates for new materials.

B. Perform sandblasting, chipping, grinding, acid washing, etching and other work as required by conditions encountered and new materials involved.

C. Use of acids or other cleaning agents shall include neutralizing, washing, rinsing and drying, as applicable.

D. Determine substrate requirements for reconditioned surfaces in cooperation with the manufacturer's representative and installer of each new material involved.

3.7 CLEAN UP

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

END OF SECTION

SECTION 03 05 80

UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied Under This Section
1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

B. RELATED SECTIONS
1. Section 03 30 00 Cast-in-place Structural Concrete
2. Section 01 45 23 Structural Testing and Inspection

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM E 1745-97 (2004) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
2. ASTM E 154-88 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
4. ASTM E 1643-98 (2005) Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)
1. ACI 302.2R-06 Vapor Barrier Component (plastic membrane) is not less than 10 mils thick.

1.3 SUBMITTALS

A. Quality Control / Assurance
1. Full set of test results as per paragraph 8.3 of ASTM E 1745.
2. Manufacturer’s samples, literature
3. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.

1.4 SUBSTITUTIONS

A. Product Review
1. Request must be made 14 days prior to bid date to allow time for proper review. Reviews will be at contractor’s expense.
2. Independent laboratory test results showing compliance with ASTM E 1745 Class A, a permeance less than 0.01 Perms (grains/(ft2 *hr * in. Hg) before and after the mandatory conditioning tests ASTM E 154 Sections 8,11,12, and 13. (Woven, and recycled plastics are not permitted
3. Incomplete substitutions will not be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Barrier (Performance based specification). When the specifications of different sections conflict, the contractor shall perform to the most restrictive provision. Vapor Barrier membrane must have the following properties.
1. Permeance as tested after mandatory conditioning (ASTM E 154 sections 8,11,12,13) less than 0.01 Perms [grains/(ft2 *hr * in.Hg)]
2. Other performance criteria
a. Strength: ASTM E 1745 Class A
b. Thickness: 15 mils minimum

2.2 ACCESSORIES

A. Seam Tape
1. Tape must have the following qualities:
a. Water Vapor Transmission Rate ASTM E 96, 0.3 perms or lower
2. Seam Tape
a. Manufacturer's standard seam tape.
b. Stego Crete Claw (for slabs on void boxes).

B. Vapor Proofing Mastic
1. Mastic must have the following qualities:
a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower

C. Pipe Boots
1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect or geotechnical firm
1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier/Retarder:
1. Installation shall be in accordance with manufacturer's written instructions and ASTM E 1643-09.
a. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
b. Lap Vapor Barrier/Retarder over footings or seal to foundation walls.
c. Overlap joints 6 inches and seal with manufacturer's tape.
d. Seal all penetrations (including pipes) per manufacturer's instructions.
e. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
f. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION 03 05 80

SECTION 03 11 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Formwork with accessories for the cast-in-place concrete and permanent shoring.

B. Related Sections:
1. Section 31 23 00 - Excavation and Fill: temporary sheeting for excavations.

1.2 QUALITY ASSURANCE

A. Standard: Formwork shall meet the requirements of ACI 347.

B. Surface Tolerances: Allowable tolerances for formed concrete surfaces shall be ⅜" maximum in 20 feet for vertical surfaces out of plumb and ¼" maximum in 20 feet for horizontal surfaces out of plane.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Lumber: S2S&CM or S2S&SL No. 3 Boards or better Southern Pine not less than a nominal 1" thick.

B. Plywood: EXT-APA grade-trademarked B-B Plyform, Class I, or High Density Overlaid Plyform, Class I. B-B Plyform shall be sanded but not mill oiled. Plywood shall be new.

C. Fiberboard: Corrugated fiberboard laminated with waterproof adhesive and coated with water resistant compound.
1. Forms in a completely dry condition shall be capable of supporting not less than the following loading without deflection:
a. 1,000 psf for walls/beams 5' or less in height.
b. 1,600 psf for walls exceeding 5' but less than 8' in height.
c. Greater than 1,600 psf for custom designed walls exceeding 8' in height.
2. Fiberboard void forms for beam soffits below grade and slab voids shall be rectangular forms.
3. Fiberboard void forms to correctly void the circular edge of beam soffits to a drilled pier, and slab drops at piers such as ArcVoid and SureRound PierVoid as manufactured by SureVoid Products, Inc., Englewood, CO (phone 888.803.8643 web site: www.surevoid.com).
4. Topping sheet shall be ¼" masonite

D. Soil Retainer Boards:
1. Foam Board Panels: Styrofoam Brand Square Edge Rigid Insulation as manufactured by Dow Chemical Co. Retainer boards shall have a flexural strength of 50 psi (ASTM C 203), shear strength of 35 psi (ASTM D 393), compressive strength of 25 psi (ASTM D 1621) and a tensile strength of 50 psi (ASTM D 1623), supplied in 1" = 4"-6" void forms, 1½" = 8" forms, or 2" = 10"-12" forms thickness.
2. Plastic Boards: Retainer boards shall be a cambered, ribbed and made of high density polyethylene. Retainer boards shall have superior strength to resist lateral loads applied by compacted soil, be impact resistant and capable of being exposed to moisture without deterioration. Product/manufacturer; Motzblock, M&M Construction Specialties (phone 800.937.9493).

E. Expansion Joint Filler:
1. Concealed: ASTM D 1751, asphalt saturated cane fiberboard.
2. Exposed: ASTM D 1752, Type I, premolded, non-bituminous, closed cell sponge rubber. Color to be stone gray.

2.2 ACCESSORIES

A. Form Ties: Form ties for exposed concrete surfaces shall be manufactured to allow a positive breakback of at least 1" inside the concrete surface. Ties shall be equipped with a plastic cone or washer not less than 1" in diameter and 1" long which will cover the hole and prevent leakage of mortar. Form ties for unexposed surfaces shall be bolt rods or patented devices having a minimum tensile strength of 3000 pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than ⅞" in diameter, or depressions back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within 1" of the finished surface of the concrete.

B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or affect bond of subsequent surface finish manufactured by Nox-Crete, Symons, or approved equivalent.

C. Dovetail Anchor Slots: 24 gage galvanized steel anchor slots with ⅝" throat, 1" deep, furnished with foam or felt fillers to exclude grout seepage.

D. Plastic Waterstops: Multiple rib extruded strips of PVC resin ⅜" thick and 6" wide. Product/manufacturer; one of the following:
   Type 5; Grace Construction Products
   No. 705; Greenstreak Plastic Products
   RB6-38; Vinylex Corp.

E. Chamfer Strips: Extruded plastic triangular chamfer with ¾" face; Burke "CSF-¾", Greenstreak Cat. No. 612.

PART 3 - EXECUTION

3.1 FORMWORK

A. General: Construct forms in compliance with referenced standard. All forms, shores, falsework, bracing and other temporary supports shall be engineered by the Contractor to support all loads imposed during construction, including weight of construction equipment, allowance for live loads and lateral forces due to wind and temporary imbalance of discontinuity of building components.

B. Construction: Construct forms to the dimensions and shapes of the concrete members as detailed and scheduled; and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Set, assemble and brace forms to withstand wet concrete construction loads without deflection, movement, or leakage. Provide access for placing and adjusting reinforcement and cleaning forms.
   1. Exposed Surfaces: Form with plywood the non-wearing concrete surfaces exposed to view. On these surfaces locate the form ties in uniform patterns. The joints shall be tight and flush. Plywood may be re-used only with the specific approval of the Architect. Chamfer exposed outside corners.
   2. Concealed Surfaces: Form with wood or metal forms the concealed vertical surfaces of grade beams and walls below grade.
   3. Soffits: Form the soffits of grade beams and walls bearing on piers using rectangular fiberboard set forms.
   4. Slab Voids: Install forms continuous and tightly butted together. Cut forms tight around all projections. Prior to placing reinforcement, entire carton form area shall be covered with masonite
   5. Metal Anchors: Install dovetail anchor slots in concrete for anchoring masonry facing and partitions to concrete. On concrete wall and beam surfaces which are faced more than 12" high with masonry, place slots vertically and on 24" centers. On concrete columns faced with masonry and where a masonry partition abuts such a column, place a continuous vertical slot in each face of the column as required to secure the masonry.
   6. Recesses and Chases: Form for and provide in their proper locations all slots, chases and recesses indicated or implied by the drawings and not formed by sleeves, frames, and other equipment furnished under other sections. The trades requiring such recesses and openings in concrete shall furnish the necessary information for their correct location and placement.
   7. Joint Waterstops: Provide continuous waterstops for joints in the concrete walls below grade and in other concrete joints where detailed. Install waterstops with one-half the width encased in the concrete on the first pour and the other half in the second pour. Make end points watertight by fusing with a hot iron. Prefabrication of corners and whole frames is recommended where this is practical.

C. Inserts and Fasteners: Provide for the installation of inserts, conduits, sleeves, drains, hangers, nosings, metal reglets, nailing strips, and like items required for the attachment of other work and furnished by other trades. Properly locate in cooperation with other trades and secure in position before concrete is placed.

D. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

E. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

F. Installing Shoring: Before backfilling, install permanent shoring along the bottom of concrete grade beams around areas of suspended floor construction to prevent caving of backfill material into the under floor areas. Provide shoring where the under floor grade at a beam is below the beam soffit.
   1. Dig the shoring at least 5" into the soil at the bottom and lap it approximately 3" up over the outside face of the beam or wall.
   2. Cut the panels to fit snugly at piers, footings, corners, and other irregularities.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 REMOVAL OF FORMS

A. Remove forms with sufficient care to avoid scarring exposed surfaces. Prying against face of concrete will not be permitted. Remove forms completely so that no wood form material is left in contact with concrete. Only fiberboard soffit forms may be left in place.
   1. General: Formwork for walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, but in no event before concrete is 24 hours old. Formwork for beam soffits and other parts that support the weight of concrete shall remain in place until the concrete has reached its specified 28-day strength unless otherwise permitted. When shores and other vertical supports are so arranged that the form facing material may be removed without loosening or disturbing the shores and supports, the facing material only may be removed at an age of 24 hours. Whenever the formwork is removed during the curing period, the exposed concrete shall be cured.
   2. Re-shoring: When re-shoring is permitted or required, the operations shall be planned in advance and shall be subject to review. Re-shoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support their own weight. While re-shoring is under way, no live loads shall be permitted on the new construction. Re-shores shall be tightened to carry their required loads, but they shall not be over-tightened so that the new construction is over-stressed. Re-shores shall remain in place until the concrete has reached its specified 28-day strength and while weights or loads in excess of design live loads are imposed.
   3. Permanent shoring shall not be removed.

3.4 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than three times for concrete surfaces to be exposed to view. Do not patch formwork.

3.5 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

END OF SECTION

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SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete reinforcement, for the following:
1. Footings and/or piers.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.
6. Building frame members.
7. Building walls.

B. Related Sections:
1. Section 01 45 23 “Testing and Inspection Services”.
2. Section 03 10 00 “Concrete Forming and Accessories”.
3. Section 03 30 00 “Cast In Place Concrete”.
4. Section 03 47 13 “Tilt Up Concrete”.
5. Section 03 38 16 “Unbonded Post Tensioned Concrete”.
6. Section 04 22 00 “Concrete Unit Masonry”.
7. Section 31 20 00 "Earth Moving".
8. Section 31 63 29 "Drilled Concrete Piers".

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. American Concrete Institute (ACI)
   a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
   b. ACI 301 – Specifications for Structural Concrete for Buildings
   c. ACI 315 – Details and Detailing of Concrete Reinforcement
   d. SP-66 ACI Detailing Manual
2. American Welding Society (AWS)
   a. AWS D1.1 – Structural Welding Code
3. Concrete Reinforcing Steel Institute (CRSI)
   a. CRSI – Manual of Standard Practice
   b. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
   c. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

B. American Society of Testing Materials (ASTM)
   a. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.
   b. ASTM-A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.

c. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
d. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
e. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
f. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
g. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.

C. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement, according to ACI 315 “Details and Detailing of Concrete Reinforcement.”
1. Do not reproduce the structural drawings for use as shop drawings.

D. Bar Supports: Submit manufacturer’s product information for bolsters, chairs, spaces, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency, installer, and fabricator as indicated herein.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Steel reinforcement and accessories.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Installer Qualifications: An experienced installer who has completed reinforcing installation work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

C. Fabricator Qualifications: An experienced fabricator who has completed reinforcing fabrication work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

E. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615, Grade 60.

C. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60 or ASTM A 706, deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 82, as drawn .

E. Deformed-Steel Wire: ASTM A 496.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, or other unacceptable materials.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Combined tolerances for formwork, reinforcing fabrication, and reinforcing placement shall not permit a reduction in specified

concrete cover of reinforcing steel. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken material. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:

1. Sheared length: Plus or minus 1 inch.
2. Depth of truss bars: Plus 0, minus ½ inch.
3. Overall dimensions of stirrups, ties, and spirals: Plus or minus ½ inch.
4. Other bends: Plus or minus 1 inch.

B. For bars with end bearing splice couplers, bar ends shall terminate in flat surfaces, within 1.5 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

2.4 DOWEL BAR ANCHORS/SPLICERS

A. A. Provide dowel bar anchors and threaded dowels designed to develop, both in tension and compression, 125% of the minimum ASTM specified yield strength of the dowel bars, as evidenced by published I.C.B.O. test reports. Unless otherwise indicated, anchors shall be furnished with ACI standard 90 degree hooks. Dowels shall be furnished by anchor supplier. The following dowel splicing systems are acceptable.

1. Richmond Screw Anchor “Dowel Bar Splicer”
2. Erico “Lenton Form Saver”
3. Dayton Barsplice “Grip-Twist”

2.5 MECHANICAL SPLICES

A. A. Provide mechanical splices designed to develop, both in tension and compression, 125% of minimum ASTM yield strength of the smaller bar being coupled, as evidenced by published I.C.B.O test reports. The following bar splicing systems are acceptable.

1. Erico “Cadweld C-Series”
2. Erico “Lenton”
3. Dayton Barsplice “Bar Grip”
4. Dayton Barsplice “Grip Twist”

2.6 METAL ANCHORAGE AND EMBEDDED METAL ASSEMBLIES

A. Steel Shapes and Plates: Conform to ASTM A36, “Specification for Structural Steel”.

B. Headed Stud Anchors: Headed studs welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

C. Welding Electrodes: AWS 5.5, Series E70.

D. Welded Deformed Bar Anchors: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

E. All metal assemblies exposed to earth, weather or moisture, including exposure to a crawl space environment, shall be hot dip galvanized.

2.7 FABRICATION OF METAL ACCESSORIES AND EMBEDDED METAL ASSEMBLIES

A. Fabricate and assemble structural steel items in the shop. Shearing, flame cutting, and chipping shall be done carefully and accurately. Holes shall be cut, drilled, or punched at right angles to the surface of metal and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges. Welded construction shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings,” and AWS D1.1. Welding shall be done by AWS certified welders.

B. Welding of deformed bar anchors and headed stud anchors shall be done by full fusion process equal to that of TRW Nelson Stud Welding Division of KSM Welding Services Division, Omark, Ind. A minimum of two headed studs shall be tested at start of each production period for proper quality control. Studs shall be capable of being bent 45 degrees without weld failure.

C. Welding of reinforcement shall be done in strict accordance with AWS requirements, using recommended preheat temperature and electrode for type of reinforcement being welded. Bars larger than No. 9 shall not be welded. Welding shall be performed subject to the observance and testing laboratory. Under no circumstances is ordinary reinforcing (ASTM A615) to be welded.

D. Coatings, where required, shall be applied after fabrication and prior to casting concrete.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Provide minimum concrete covering for reinforcement as shown in the Structural General Notes.

G. Place bars to following tolerances:
   1. Clear distance to formed surfaces: Plus or minus ¼ inch.
   2. Minimum spacing between bars: Minus ¼ inch.
   3. Top bars in slabs and beams:
      a. Members 8 inches deep or less: Plus or minus ¼ inch.
      b. Members between 8 and 24 inches deep: Plus or minus ½ inch.
      c. Members more than 24 inches deep: Plus or minus 1 inch.
   4. Crosswise of members: Spaced evenly within 2 inches.

5. Length of members: Plus or minus 2 inches.

H. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.

I. Support reinforcement and fasten together to prevent displacement by construction loads or placing concrete beyond tolerances indicated.

J. Unless permitted by Engineer, do not bend reinforcement after embedding in hardened concrete.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.

END OF SECTION 03 20 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
1. Foundation walls.
2. Slabs-on-grade.
3. Suspended slabs.
4. Concrete toppings.
5. Building frame members.
6. Building walls.

B. Related Sections:
1. Section 01 45 23 “Structural Testing and Inspection Services”.
2. Section 03 20 00 "Concrete Forming and Accessories".
3. Section 03 10 00 "Concrete Reinforcing".
4. Section 03 11 31 “Void Forms”.
5. Section 03 15 13 “Waterstops”.
6. Section 03 05 80 “Under-slab Vapor Barrier – Retarder”.
7. Section 03 47 13 “Tilt Up Concrete”.
8. Section 31 63 29 “Drilled Concrete Piers and Shafts”.

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. ACI 301 – Specification for Structural Concrete.
2. ACI 302 – Guide for Concrete Floor Slab Construction.
3. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305 – Hot Weather Concreting.
5. ACI 306 – Cold Weather Concreting.
6. ACI 308 – Guide to Curing Concrete.
7. ACI 309 – Guide for Consolidating Concrete.
8. ACI 311 – ACI Manual for Concrete Inspection.
9. ACI 318 – Building Code Requirements for Reinforced Concrete.
10. ACI 347 – Guide to Concrete Formwork.
11. ACI 207 – Mass Concrete.
12. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
13. ACI 211.2 – Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
14. ACI 212.3 – Chemical Admixture for Concrete.
15. ACI 212.4 – Guide for the use of High Range Water Reducing Admixtures in Concrete.
16. ACI 214 – Evaluation of Strength Test Results of Concrete.
17. ACI 303 – Guide to Cast in Place Architectural Concrete Practice.
18. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit IEQ 4.3: For liquid floor treatments and curing and sealing compounds, documentation including printed statement of VOC content.
3. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for Portland cement or other Portland cement replacements, and for equivalent concrete mixtures that do not contain Portland cement replacements.

C. Design Mixtures: For each concrete mixture include the following information. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Each proposed mix design shall be accompanied by a complete standard deviation analysis based on at least 30 consecutive strength tests, or by three laboratory trial mixtures with confirmation tests.
2. Proportions of cement, fine, and coarse aggregate, and water.
3. Design strength.
4. Maximum slump.
5. Air Content.
6. Maximum water / cement ratio.
7. Maximum and minimum concrete temperature that is acceptable at time of placement for which the manufacturer can guarantee the strength of the concrete.
8. Type cement and aggregates.
9. Type and quantities of all admixtures.
10. Air dry density and splitting tensile strength for lightweight concrete determined in accordance with ASTM 330.
11. Type, color, and quantities of integral coloring compounds, where applicable.
12. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Refer Section 03 20 00.

E. Formwork Shop Drawings: Refer Section 03 10 00.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Semi rigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: See Section 01 45 23.
1. Contractor’s responsibility to testing laboratory.
a. Furnish all labor and materials as required to assist testing agency in obtaining, making and handling samples at the jobsite.
b. Advise the Owner’s Testing Laboratory sufficiently in advance of operations to allow adequate time for the assignment of testing personnel.
c. Furnish and maintain adequate facilities for proper curing of concrete test specimens on the project site in accordance with ASTM C31.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.

H. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. See Section 03 10 00.

2.2 STEEL REINFORCEMENT

A. See Section 03 20 00.

2.3 REINFORCEMENT ACCESSORIES

A. See Section 03 20 00.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I or Type I/II, gray. Supplement with the following:
a. Fly Ash: ASTM C 618, Class F or C. Carbon content shall not exceed 3 percent by volume.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal as indicated on Drawings for specific uses.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain not more than 0.05 percent water soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ChemMasters.
      b. Davis Colors.
      c. Dayton Superior Corporation.
      d. Hoover Color Corporation.
      e. Lambert Corporation.
      f. QC Construction Products.
      g. Rockwood Pigments NA, Inc.
      h. Scofield, L. M. Company.
      i. Solomon Colors, Inc.
   2. Color: As selected by Architect from manufacturer's full range.

2.6 FIBER REINFORCEMENT

Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1 to 2-1/4 inches long.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. 3M; Scotchcast Polyolefin Fibers 2".
      b. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
      c. FORTA Corporation; FORTA FERRO.
      d. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.
      e. Nycon, Inc.; XL.
      f. Propex Concrete Systems Corp.; Fibermesh 650.
      g. Sika Corporation; Sika Fiber MS or MS10.

2.7 CONCRETE MIX DESIGNS

A. Selection of Proportions: Proportions of ingredients for concrete mixes shall be determined by a qualified concrete supplier in accordance with the requirements of ACI 301.

B. Required average strength above specified strength: Determination of required average strength above specified strength shall be based on the standard deviation record of the production facility in accordance with ACI 301. Calculation of standard deviation of compressive strength results shall be made in accordance with ACI 214. If a suitable record of strength tests is not available, proportions shall be selected on the basis of laboratory trial batches to produce an average strength greater than the strength f'c by the amount defined in ACI 301.

2.8 VAPOR RETARDERS

A. See Section 03 05 80.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Anti-Hydro International, Inc.; Emery.
b. Dayton Superior Corporation; Emery Tuff Non-Slip.
c. Lambert Corporation; EMAG-20.
d. L&M Construction Chemicals, Inc.; Grip It.
e. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Anti-Hydro International, Inc.; A-H Alox.
b. BASF Construction Chemicals - Building Systems; Frictex NS.
c. L&M Construction Chemicals, Inc.; Grip It AO.

LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ChemMasters; Chemisil Plus.
b. ChemTec Int'l; ChemTec One.
c. Conspec by Dayton Superior; Intraseal.
d. Curecrete Distribution Inc.; Ashford Formula.
e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
f. Edoco by Dayton Superior; Titan Hard.
g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
h. Kaufman Products, Inc.; SureHard.
i. L&M Construction Chemicals, Inc.; Seal Hard.
j. Meadows, W. R., Inc.; LIQUI-HARD.
k. Metalcrete Industries; Floorsaver.
l. Nox-Crete Products Group; Duro-Nox.
m. Symons by Dayton Superior; Buff Hard.
n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Advanced Floor Products; Retro-Plate 99.
b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
   b. BASF Construction Chemicals - Building Systems; Confilm.
   c. ChemMasters; SprayFilm.
   d. Conspec by Dayton Superior; Aquafilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; Vapor-Aid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group; MONOFILM.
   n. Sika Corporation; SikaFilm.
   o. SpecChem, LLC; Spec Film.
   p. Symons by Dayton Superior; Finishing Aid.
   q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
   r. Unitex; PRO-FILM.
   s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. BASF Construction Chemicals - Building Systems; Kure 200.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec by Dayton Superior; W.B. Resin Cure.
      e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      f. Edoco by Dayton Superior; Res X Cure WB.
      g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      h. Kaufman Products, Inc.; Thinfilm 420.
      i. Lambert Corporation; AQUA KURE - CLEAR.
      j. L&M Construction Chemicals, Inc.; L&M Cure R.
      k. Meadows, W. R., Inc.; 1100-CLEAR.
      l. Nox-Crete Products Group; Resin Cure E.
      m. Right Pointe; Clear Water Resin.
      n. SpecChem, LLC; Spec Rez Clear.
      o. Symons by Dayton Superior; Resi-Chem Clear.
      p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
      q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Kure 1315.
      b. ChemMasters; Polyseal WB.
      c. Conspec by Dayton Superior; Sealcure 1315 WB.
      d. Edoco by Dayton Superior; Cureseal 1315 WB.
      e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
      f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
      g. Lambert Corporation; UV Safe Seal.
      h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
      i. Meadows, W. R., Inc.; Vocomp-30.
      j. Metalcrete Industries; Metcure 30.

k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.14 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, as indicated in Structural General Notes.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.15 NON-SHRINK GROUT

A. Grout shall be prepackaged, non metallic, and non gaseous. It shall be non-shrink when tested in accordance with ASTM-C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees to 90 degrees Fahrenheit. Grout shall be bleed free and attain 7,500 psi compressive strength in 28 days at fluid consistency. Certified independent test data required. Approved products include the following:
1. “Euco NS” by Euclid Chemical Company
2. “Masterflow 713” by Master Builders.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated in Structural General Notes:

2.17 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.18 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. See Section 03 10 00.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. See Section 03 10 00.

3.4 SHORES AND RESHORES

A. See Section 03 10 00.

3.5 VAPOR RETARDERS/BARRIERS

A. See Section 03 05 80.

3.6 STEEL REINFORCEMENT

A. See Section 03 20 00

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are specified or otherwise indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Do not permit concrete to drop freely any distance greater than 10’-0” for concrete containing a high range water reducing admixture or 5’-0” for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. See Section 03 10 00.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated and/or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated and/or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated and/or exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces according to ASTM E 1155, for a randomly trafficked floor surface.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistivegranules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive granules.

3.11 Concrete Floor Finish Tolerances

A. Interior Finish Floor surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." The following values apply before removal of shores. Levelness values F(L) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
1. Exposed, vinyl tiled, or thin-set tiled floors: Specified overall values of flatness, Ff =35; and levelness, Fl =25; with minimum local values of flatness, Ff =24; and levelness, Fl =17.
2. Carpeted floors, floors under concrete toppings, thickset tile and terrazzo: Specified overall values of flatness, Ff =25; and levelness, Fl = 20; with minimum local values of flatness, Ff =17; and levelness, Fl =15.

B. Floor Elevation Tolerance Envelope:
1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
a. Slab-on-Grade, or Slab-on-Void Construction: +/- 3/4"
b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
c. Top surfaces of all other slabs: +/- 3/4"
d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturers written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete

surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.
1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
2. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

SECTION 03 35 43

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Installation of polished concrete floor system for new and/or existing interior concrete floors by dry grinding, application of concrete densifier, and polishing with various size grit metal-bonded and resin-bonded diamonds to the scheduled specified minimum local and overall gloss values.
2. Application of chemical dye

B. Related Sections:
1. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 07 92 00 - Joint Sealants.
4. Section 09 65 00 - Resilient Flooring; Rubber base.

1.2 REFERENCES

A. ASTM C 1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.

B. ASTM D 523 - Standard Test Method for Specular Gloss.

C. NFSI - National Floor Safety Institute; Test Method 101A; current edition.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. For each type of chemical product indicated, submit current specifications and product literature, as printed by the manufacturer of the products specified herein.
2. Submit information on all grinding equipment to be used.
a. Planetary grinder polishing equipment
b. Planetary grinder HEPA dust collection equipment
c. Hand tools
d. Hand tool dust collection equipment
e. Diamond tooling
f. High speed propane burnisher
g. Polyurea pump
h. Joint cutting saw
3. Manufacturer’s chemical and product data sheets for:
a. Specified dye
b. Liquid reactive surface densifier
c. Liquid stain guard treatment
d. Joint filler
e. Crack and spall repair product
f. Self-leveling, dye-able, polishable overlay product
g. Grout coat, pin hole and small defect surface treatment
4. All proposed materials and methods of application are subject to review by the Architect and Owner.

C. Samples: Submit manufacturer’s full color palette for concrete coloring materials.

D. Installer’s Certification:
1. Provide list of 5 projects performed with last three years of similar type, size and complexity. Submit project names, addresses, contacts and phone numbers for each project. General Contractor is to validate references and polisher’s capabilities prior to submitting bid.

2. Applicator Qualifications: Submit letter of certification from each of the following manufacturers of products and equipment specified herein, stating that the applicator is a certified applicator of the system and is familiar with proper procedures and installation methods as required by the manufacturer.
   a. Planetary grinder system
   b. Liquid reactive surface densifier and stain guard treatment
   c. Joint filler, crack and spall repair products

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAGs) for Buildings and Facilities; Final Guidelines, revisions, and updates for static coefficient of friction for walkway surfaces.
   2. Environmental Requirements: Comply with current Federal and local toxicity and air quality regulations and with Federal requirements on content of lead, mercury, and other heavy metals. Do not use solvents in floor polish products that contribute to air pollution or impact food quality.

B. Qualifications:
   1. Installer trained and holding current certification for installation of specified products and polishing system.
   2. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project. Contractor shall have completed 5 jobs of similar size, scope and complexity within the last 2 years.
   3. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

C. Mock-Up: Prior to installation of dyed concrete finish system.
   1. Accepted mock-up shall remain as part of finished product.
   2. Mock-Up size will be 100 sq. ft. at project site at location as directed by Architect. Mock-up will be under conditions similar to those which will exist during actual placement.
   3. Mock-up will include properly repaired surface spalls, slab joints and slab edge treatments including complementary edge banding.
   4. Mock-up will be used to judge concrete substrate preparation, workmanship, operation of equipment, material application, color selection and shine.
   5. Allow a minimum of 24 hours for inspection of mock-up. Mock-up shall be accepted before proceeding with work and before any color or pattern work is started.

D. Pre-installation Meetings: Schedule and convene a pre-installation meeting at the project site before start of installation of polished concrete floor system
   1. Meeting to occur only after review and approval of required Sub-contractor submittals and completion of test panel mock-up, including specified grinding, polishing and dye, joint filling, spall and crack repairs, and specified overall gloss values.
   2. Required attendance of parties directly affecting work of this section, including:
      a. Project Architect
      b. Polishing Consultant, if retained on project.
      c. General Contractor
      d. Polishing Subcontractor including Project Manager and Foreman
   3. Pre-installation meeting agenda to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Review the following:
      a. Existing conditions.
      b. Environmental requirements.
      c. Scheduling and phasing of work.
      d. Coordinating with other work and personnel.
      e. Protection of adjacent surfaces.
      f. Surface preparation.
      g. Repair of defects and defective work prior to installation.
      h. Cleaning.
      i. Installation of polished floor finishes.
      j. Application of liquid hardener, densifier.
      k. Protection of finished surfaces after installation.

1.5 PROJECT CONDITIONS

A. Sequence application of concrete polishing after completion of other construction activities that would be damaging to the completed polished concrete finish.

B. Close areas to traffic during and after floor application for time period recommended in writing by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

C. Waste Management and Disposal: Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.7 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit 10-year warranty signed by polished concrete contractor for failure and replacement of materials and workmanship executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

C. Warranty commences on date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Provide Polished Concrete Finishing Products by Ameripolish Concrete Polishing System™ (phone: 800.725.0033) or approved equal.
   1. Machinery Requirements: HTC Systems Unit 800 or SASE Diamatic System Unit 780 or equivalent size and head pressure machinery made for grinding concrete.
   2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
   3. Low Viscosity Crack and Spall Repair: Rapid Refloor in complementary matching color, by Metzger McGuire or approved equivalent.
   4. Wide Area Surface Repairs: Diama-Top by Ardex Engineered Cements or approved equivalent.
   5. Pin Hole and Surface Pitting Grout Coat: Diama-Fill, by Ardex Engineered Cements or approved equivalent.
   6. Concrete Hardener, Densifier: Water based, odorless liquid, VOC compliant, chemical hardening solution leaving no surface film.
   7. Concrete Colorant: Fast-drying dye, packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces.
      a. Color: As scheduled in Color Schedule.
      b. Finish: Standard High gloss (HG-1), 1500 grit.Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
   8. Cleaning Solution: Mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).

B. Design Requirements:
   1. Hardened Concrete Properties:
      a. Minimum Concrete Compressive Strength: 3500 psi.
      b. Normal Weight Concrete: No lightweight aggregate.
      c. Non-air entrained.

2. Placement Properties:
   a. Natural concrete slump of 4-1/2 inches - 5 inches. Admixtures may be used.
   b. Flatness Requirements:
      1) Overall FF 40.
      2) Local FF 20.
3. Hard-Steel Troweled (3 passes) Concrete:
   a. No burn marks. Finish to ACI 302.1R, Class 5 floor.
4. Curing Options:
   a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure).
      1) Acrylic curing and sealing compounds not recommended.
   b. Sheet membrane (ASTM C171); polyethylene film not recommended.
   c. Damp Curing: Seven day cure.

2.2 SYSTEM DESCRIPTION AND PERFORAMCE

A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:
   1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch wear in 30 minutes.
   2. Reflectivity: Increase of 35% as determined by standard gloss meter.
   3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
   4. High Traction Rating: NFSI 101-A, non-slip properties.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.

B. Verify Concrete Slab Performance Requirements:
   1. Verify concrete is cured to 28 day, at strength as specified in Section 03 30 00 - Cast-In-Place Concrete.
   2. Floor and Joints: Dry and free of debris and excessive dirt, dust, clay, and mud.
   3. Floor Finish: Wide channel floated, smooth, pan, combination blade and plastic blade finished floor from edge to edge, with no rough areas. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement.
   4. Concrete Adjacent to Floor Penetrations: Troweled flat and level with surrounding concrete.

C. Notify the General Contractor in writing of conditions that would adversely affect installation or subsequent use prior to commencement of polishing.

D. Do not begin surface preparation or installation until conditions are corrected and approved.

3.2 PREPARATION

A. Examine surface to determine soundness of concrete for polishing.

B. Remove surface contamination, fins and projections.

C. Chalk lines laid out for any purpose are acceptable as long as they are not sprayed down with clear acrylic.

D. Protection: Protect surrounding areas and adjacent surfaces from the following:
   1. Minimal accumulation of dust from grinding and polishing.
   2. Contact with overspray of penetrating hardener / densifier.
   3. Contact with overspray of protective surface treatment (stain guard)
   4. Contact with overspray of water or solvent based dye treatment.
   5. Contact with joint filler, crack or spall repair materials

E. On existing concrete floors, completely remove existing flooring, mastics, adhesives, self-leveling underlayment fillers and other foreign matter.

F. On existing concrete floors, remove the top ½ of an inch of existing joint material and replace with approved joint filler and crack repair products.

G. Clean Surfaces: Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants which could adversely affect installation of polished concrete floor system.

3.3 INSTALLATION

A. Install polished concrete floor system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Aggregate Exposure:
1. Fine Aggregate: Mottled salt-and-pepper aggregate exposure.

C. Polished Concrete Floor System
1. Open Slab Surface:
   a. As required to provide a uniform final polish or removal of existing floor coatings, begin grinding with 40 or 80-grit metal bond. Bids shall be based on starting initial cut with 40-grit metal diamonds. Expose coarse concrete aggregate when required to reach lows spots within floor surface.
   b. Review condition of floor. Obtain written approval if large coarse aggregate is required to be exposed to remove existing coatings, floor underlayment or slab deficiencies. Variations to the precise grinding, densifying, polishing, dying and stain guard application are anticipated, but must be discussed and approved in writing prior to executing the work.
   c. For new concrete floors, open-up concrete by grinding with 80-grit metal-bonded.
   d. Progressive edge grinding will be necessary with ½" of all vertical abutments, including walls, cases, columns, posts and racking systems.
   e. Joint filler and spall repairs shall be flush with surface after grinding and polishing steps. Additional passes along curled joints may be necessary to remove joint filler chatter.
2. Remove metal-bonded diamond scratches by grinding with progressively finer metal-bonded diamonds, up to metal bond 150-grit.
3. Apply densifier
   a. Per manufacturer's recommendations and the concrete's acceptance of the product.
4. Floor Polishing:
   a. Remove 150-grit metal-bonded diamond scratches by grinding with a transitional diamond per manufacturers recommendation
   b. Remove 800-grit resin-bonded diamond scratches by grinding with 1500-grit resin-bonded diamonds.
5. Apply stain guard
   a. Apply in accordance with manufacturer's published instructions.
   b. Apply first coat per manufacturer's recommendation (DO NOT OVER APPLY).
   c. Use applicator pad, pre-wetted with stain guard, to pull material out to create a thin film prior to drying.
   d. Remove product completely from areas of over application, as evidenced by surface streaking, and replace with unused stain guard.
   e. Apply second coat of stain guard at all high traffic areas identified on the drawings per manufacturer's instructions.
6. High speed burnish:
   a. After each application of stain guard is dry, burnish surface.
   b. Burnish using approved pads, at a slow movement pace using high speed machine with 400 or 800 grit diamond impregnated pads as required to achieve specified gloss requirements.
   c. Burnish with several passes. Make each progressive pass at 90 degrees from previous pass.
   d. Burnishing, pad type, and pace of forward movement shall combine to develop a minimum floor surface temperature of 91-degrees F directly below the burnishing pad as continuously measured by the operator during installation.

3.4 FIELD QUALITY CONTROL

A. Inspect completed polished concrete floor system with the Architect, Concrete Consultant, General Contractor, and Polished Concrete Installer.

B. Review procedures with owners Consultant to correct unacceptable areas of completed polished concrete floor system.

C. Specular Gloss/Reflectance, ASTM D 523:
   1. Perform polishing and burnishing work necessary to produce a Specified Overall Gloss Value (SOGV) ≥ 50 prior to applying protective surface treatment, SOGV ≥ 60 after applying protective surface treatment, Minimum Local Gloss Value (MLGV) ≥ 40 after applying protective surface treatment as measured using a Horiba IG-320 60 Degree Gloss Checker.
   2. Gloss shall be considered as a quantitative value that expresses the degree of reflection when light hits the concrete floor surface. Gloss measurements will be taken independent of ambient lighting and will be taken within a sealed measurement window located beneath the test unit.
   3. Collects 12 readings minimum, throw out low and high measurements and average remaining measurements. Average shall exceed SOGV. No single measurement shall be less than MLGV.

3.5 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface.

3.6 FINAL CLEANING

A. Final clean in accordance with Section 01 74 13 - Progress Cleaning.

B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

C. Clean adjacent materials and surfaces and work area of foreign materials resulting from work of this section.

D. Upon completion, contractor must remove surplus and excess materials, rubbish, tools and equipment.

3.7 PROTECTION

A. Protect completed polished concrete floor system from damage until Substantial Completion.
   1. Do not allow vehicle and pedestrian traffic on unprotected floor.
   2. Do not allow construction materials, equipment, and tools on unprotected floor.
   3. Prohibit parking of vehicles on concrete slab.
   4. Protect from petroleum stains during construction.
   5. If construction equipment must be used for application, diaper components that might drip oil, hydraulic fluid, or other liquids. This is especially important with hydraulic lifts.
   6. No tire embedment (rocks, nails, screws, etc.) that will scratch or pit slab surface.
   7. Check lift tires daily for screws.
   8. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
   9. Prohibit temporary placement and storage of steel members or reinforcing steel on concrete slab.
   10. Prohibit acids and acidic detergents from contacting concrete surfaces.
   11. Cover concrete floors with drop cloths or use breathable drop cloths during painting. If paint is spilled on concrete floor, remove paint immediately.
   12. Protect slab surface from standing moisture for 72 hours to prevent re-emulsification of surface treatment prior to cure

B. Protect adjacent materials from damage during installation of polished concrete.

C. Chalk lines laid out for any purpose are acceptable as long as they are not sprayed down with clear acrylic.

D. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed polished concrete floor system.

E. Repair damaged areas of completed polished concrete floor system to satisfaction of the Architect and owners Consultant.

F. Protect completed areas with EZ Cover™ by McTech Corp. (phone: 866.913.8363 website: http://www.mctechgroup.com/ezcover.html), or comparable product.

END OF SECTION

03 41 00

PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall panels.

B. Columns and bearing saddles.

C. Beams, spandrels, girders, purlins.

D. Roof double tees.

E. Grout packing.

F. Connection and supporting devices.

G. Lintels and bond beams.

1.2 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

C. ASTM A416/A416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete; 2012a.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2014.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2013.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

G. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010 w/Errata.

I. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society;2011.

J. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete; 2010.

K. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; Precast/Prestressed Concrete Institute; 1999, Fourth Edition.

L. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; 1988, Second Edition.

M. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; Precast/Prestressed Concrete Institute; 2000.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a pre-installation conference one week prior to commencing work of this section.
   1. Discuss limitations, if any, on field cutting of openings.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.

C. Shop Drawings: Submit shop drawings signed by a licensed engineer indicating layout, unit locations, fabrication details and unit identification marks.
   1. Prepare shop drawings in accordance with pertinent provisions of Supplementary General Conditions of these Specifications and showing complete information for fabrication and erection of the work of this Section including, but not necessarily limited to:
      a. Coordinate with the General Contractor and all Subcontractors and Vendors as required to install components necessary and/or specified to be inside the wall panels. Specifically, all electrical conduit and accessories shall be embedded in the walls before pouring wall panels. And, specifically, all penetrations needed by others shall be accommodated during fabrication when locating prestressing strands and anchors.
      b. Member dimensions and cross sections; locations, size, and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection; thicknesses of walls and other elements shall be as shown on the drawings, not decreased or increased. The minimum thickness of concrete at the perimeter of the tornado shelter as defined by Sheet G3.1 shall in no instances be less than 4" which is required for missile debris impact testing compliance.
      c. Erection procedures, sequence of erection, and required handling equipment;
      d. Layout, dimensions, and identification of each precast unit corresponding to the sequence and procedure of installation;
      e. Welded connections, indicated by AWS standard symbols;
      f. Details of inserts, connections, and joints, including accessories and construction at openings in the precast units;
      g. Location and details of anchorage devices that are to be embedded in other construction.
   2. Submit reviewed shop drawings and design data to authorities having jurisdiction for approval.

D. Samples: Submit two, 12 x 12 x 4 inch in size, illustrating surface finish treatment.

E. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

F. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Texas.

B. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Fabricator Qualifications: Precast concrete fabricator accredited by IAS according to IASAC157.

D. Erector Qualifications: Company specializing in erecting products of this section with minimum three years of documented experience and approved by manufacturer.

E. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C. Protect members to prevent staining, chipping, or spalling of concrete.

D. Mark each member with date of production and final position in structure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Structural Precast Concrete:
1. Any manufacturer holding a PCI Group C Plant Certification for the types of products specified; see www.pci.org/find/manufacturer.

2.02 PRECAST UNITS

A. Precast Structural Concrete Units: Comply with ACI 301, PCI MNL-116, PCI MNL-120, PCI MNL-123, PCI MNL-135, ACI 318 and applicable codes.
1. Design components to withstand dead loads and design loads in the configuration indicated on the drawings:
2. The minimum compressive strength of wall panels shall be 5,000 psi at 28 days for compliance with debris missile impact testing specifications.
3. Calculate structural properties of framing members in accordance with ACI 318.
4. Replace Portland cement with fly ash per Section 03 30 00.
5. Design members exposed to the weather to provide for movement of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.
6. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.03 MATERIALS

A. Cement: White Portland type, conforming to ASTM C150/C150M, Type I.

B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116.

2.04 REINFORCEMENT

A. Tensioning Steel Tendons: ASTM A416/A416M, Grade 270 (1860); seven-wire stranded steel cable; low-relaxation type; full length without splices; weldless; uncoated.

B. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).
   1. Deformed billet-steel bars.
   2. Unfinished.

C. Steel Welded Wire Reinforcement: ASTM A1064/A1064M plain type or deformed type; in flat sheets; unfinished.

2.05 ACCESSORIES

A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, and items connected to steel framing members, and inserts conforming to PCI MNL-123, and as follows:
   1. Material: Carbon steel conforming to ASTM A 36/A 36M.
   2. Finish: Unfinished.
   3. Provide connectors between wall panels at all walls in a plane for each and every plane of precast wall panels to act as a composite lateral force resisting system in each plane.

B. Grout:
   1. Non-shrink, non-metallic, minimum compressive strength of 6,000 psi at 28 days.
   2. Epoxy.

C. Cotton Duck Pad between 2 steel plate precast components cast into concrete with 1/2" minimum thickness.

D. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.

E. Prime Paint: Zinc rich alkyd type.

F. Install minimum 26 gage dove tail channel anchor inserts to comply with section 042000 for all masonry veneer anchors.

2.06 FABRICATION

A. Coordinate with the General Contractor and all Subcontractors and Vendors as required to install components necessary and/or specified to be inside the wall panels. Specifically, all electrical conduit and accessories shall be embedded in the walls before pouring wall panels. And, specifically, all penetrations needed by others shall be accommodated during fabrication when locating prestressing strands and anchors.

B. Conform to fabrication procedures specified in PCI MNL-116.

C. Fabricate and handle epoxy-coated reinforcing bars in accordance with ASTM D3963/D3963M.

D. Maintain plant records and quality control program during production of precast members. Make records available upon request.

E. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.

F. Tension reinforcement tendons as required to achieve design load criteria.

G. Provide required openings with a dimension larger than 10 inches and embed accessories provided under other sections of the specifications, at indicated locations.

H. Exposed Ends at Stressing Tendons: Fill recess with non-shrink grout, trowel flush where exposed to final view. at all other conditions, provide corrosion protection coating (e.g. mastic).

2.07 FINISHES

A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.
B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
C. Finish members to PCI MNL-116 Finish B grade.

2.08 FABRICATION TOLERANCES

A. Conform to fabrication tolerances specified in PCI MNL-116, except as specifically amended below for wall panels:
   1. Variation From Nominal Dimension: Plus or minus 1/2 inch.
   2. Variation From Intended Camber: Plus or minus 1/4 in per 10 ft, plus or minus 5/8 inch maximum.
   3. Variation from End Squareness: Plus or minus 1/8 inch/12 in, maximum 3/8 in.
   4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
   5. Sweep: Plus or minus 1/4 inch.

2.09 SOURCE QUALITY CONTROL

A. An independent testing agency, will inspect for conformance to contract documents.

B. Test samples in accordance with applicable ASTM standard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as shown on shop drawings.

3.02 PREPARATION

A. Prepare support equipment for the erection procedure, temporary bracing, and induced loads during erection.

3.03 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Align and maintain uniform horizontal and vertical joints, as erection progresses.

C. Maintain temporary bracing in place until final support is provided. Protect members from staining.

D. Do not use powder actuated fasteners for surface attachment of accessory items except as specifically approved by the Architect and specifically accepted by the precast unit manufacturer.

E. Provide temporary lateral support to prevent bowing, twisting, or warping of members.

F. Adjust differential camber between precast members to tolerance before final attachment.

G. Install bearing pads.

H. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12.

I. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.

J. Grout joints between members at floor locations.

K. Secure units in place. Perform welding in accordance with AWS D1.1.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances.

B. Conform to PCI MNL-135 for erection tolerances, except as specifically amended below.
1. Plan Location from Building Grid Datum: Plus or minus 3/4 in.
2. Top Elevation from Building Elevation Datum at Plank Ends: Plus or minus 1/2 inch.
3. Maximum Jog in Alignment of Matching Ends: Plus or minus 1/2 inch.
4. Exposed Joint Dimension: Plus or minus 3/8 inch.
5. Differential Top Elevation As Erected: Plus or minus 3/8 inch.
6. Bearing Length in Span Direction: Plus or minus 3/8 inch.
7. Differential Bottom Elevation of Exposed Members: Plus or minus 3/16 inch.

C. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise Architect. Execute modifications as directed.

3.05 PROTECTION

A. Protect members from damage caused by field welding or erection operations.

B. Provide non-combustible shields during welding operations.

3.06 CLEANING

A. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION 03 41 00

SECTION 03 54 13

SELF-LEVELING UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Liquid applied gypsum floor underlayment.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry: Plywood subflooring.

1.2 SUBMITTALS

A. Submit manufacturer's mix and installation instructions under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 QUALITY ASSURANCE

A. Applicator: Company specializing in self-leveling underlayment with 3-years' experience.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Perform work at ambient temperatures at or above 50° F.

B. During cure process, ventilate room spaces to remove moisture.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Gyp Crete® 2000 Floor Underlayment as made by Maxxon Southeast, Inc. (phone 800.247.5266 web site: www.maxxonse.com/gypcrete.html).

B. Substitutions: Under provisions of SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 MATERIALS

A. Underlayment: Gypsum based cementitious mix.

B. Water: Drinkable and not detrimental to underlayment.

C. Primer: To manufacturer's instructions.

D. Joint and Crack Filler: Latex based.

E. Sand: Meeting Gyp. Crete Specification no. 101, using 1.8 cu.ft. of sand per 80 lb. of Gyp Crete.

2.3 MIXING

A. Site mix 1.4 mix design materials in accordance with manufacturer's instructions.

B. Mix to achieve following characteristics
1. Density: 115 lb/sq ft minimum dry density.
2. Compressive Strength: 2000 psi minimum in accordance with ASTM C 472.
3. Fire Hazard Classification: 0/0/0 (Flame/Fuel/Smoke) rating in accordance with ASTM E 286.

C. Mix to consistency to achieve self-leveling.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify substrate surface is ready to receive work of this Section.

3.2 PREPARATION

A. Remove nubs, projections, irregularities. Fill voids, deck joints and irregularities with filler. Finish smooth.

B. Vacuum clean substrate surfaces.

C. Prime wood substrate. Allow to dry.

3.3 INSTALLATION

A. Install underlayment in accordance with manufacturer's instructions and recommendations for minimum and maximum thicknesses.

B. Install after partition installation.

3.4 CURING

A. Air cure in accordance with manufacturer's instructions.

END OF SECTION

SECTION 04 20 00

MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Unit masonry construction.

B. Related Requirements:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 05 50 00 - Metal Fabrications: steel lintels.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
4. Section 07 65 00 - Flexible Flashing: through-wall flashing for masonry walls.
5. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.
6. Section 07 92 00 - Joint Sealants.
7. Section 07 95 00 - Expansion Control.
8. Section 08 11 00 - Hollow Metal Doors and Frames: installation of steel frames.
9. Section 10 99 00 - Miscellaneous Specialties;

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit for each type of product indicated.
1. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

C. Samples: Within 60 days after the contract has been awarded, submit manufacturer's standard sample panel showing full range of color, approximately 12" x 24" for each color and size of brick required.

D. Test Reports: Manufacturer of the concrete masonry units shall submit:
1. Certified test reports showing that the units to be furnished meet the requirements of ASTM C 90 and C 129, and have the required minimum compressive strengths.
2. Reports certifying concrete masonry units meet or exceed each of the fire-resistive ratings.

E. Provide a diagram of proposed control joints and expansion joints.

F. Submit steel reinforcing shop drawings for load-bearing concrete masonry unit walls, including elevations showing reinforcing, control joints, bond beams, dimensions and details.

G. Mortar Mixture Proportions: ASTM C 270, Submit copies of each proposed mix design for review prior to starting masonry work.

H. Grout Mixture Proportions: ASTM C 476, Submit copies of each proposed mix design for review prior to grout placement.
1. Include recent historical grout cylinder strength test reports for each mix design.

I. Pre-blended Mortar and Grout Certificates: Submit manufacturer’s certificates that products meet or exceed specified requirements.
1. Mortar: Submit test reports, per ASTM C 780, for each mortar mix indicating strength of mortar mixes. Submit computer batch-ticket to confirm the mixes meet the project SPEC MIX specifications for every bag of mortar.
2. Grout: Submit test reports, per ASTM C1019, for each grout mix indicating compressive strengths. Submit computer batch-ticket to confirm the grout mixes meet the project SPEC MIX specifications for every bag of grout.

1.3 QUALITY ASSURANCE

A. Manufacturer: Manufacturer shall have a minimum of five years’ experience manufacturing the specified product.

B. Installer: Masonry contractor shall have a minimum of five years' experience in similar types of work and be able to furnish a list of previous jobs and references if requested by the Architect.

C. Pre-installation Conference: Contractor shall schedule pre-installation conference at the project site with Architect/Engineer and Owner's Testing Lab. Conference shall be held prior to proceeding with masonry work and shall comply with requirements in Division 01 Section "Project Management and Coordination".

D. Expansion Joints (Control Joints): Provide expansion joints as shown on the Drawings or if not shown, install at frequency and in accordance with details as recommended by the N.C.M.A. or B.I.A. Confirm locations and frequency with Architect before beginning work. Refer to expansion joint Paragraph in the Installation portion of this specification section.

E. Mock-up: Construct a sample wall panel at the site using brick veneer, , mortar, and masonry backup proposed for the project. The panel shall duplicate the typical building wall construction (coursing, bonding, joint treatment, sealant, cleaning methods and materials as required in SECTION 07 92 00 - JOINT SEALANTS). Sample panel shall be fully acceptable to the Architect prior to ordering of materials. Install one vertical 3/8" control joint for full height of panel. Panel shall be not less than 4 ft. by 3 ft. Construct panel on a wood pallet, providing portability around the project site. Do not alter nor destroy mock-up until attainment of Substantial Completion. Approved mock-up panel shall be the standard of comparison for workmanship and materials.

F. Fire-resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Brick Delivery: Do not lay face brick until at least 50% of the brick for the project has been delivered. As brick work progresses, make additional deliveries of brick so that at all times at least 50% of the remaining brick requirements are on the project site. Serve masons brick intermixed from the various storage piles to assure blending of brick.

B. Store face brick and masonry units above ground on wood pallets which allow air circulation under the stacked units.

1.5 PROJECT CONDITIONS

A. Refer to "Protection" Paragraph for daily activities.

B. Cold Weather Construction: Do no masonry work when freezing weather is expected. If Contractor elects to lay masonry when air temperature falls or is expected to fall below 40°F., provide construction means and protection of completed masonry as described in BIA Technical Note 1 - Cold and Hot Weather Construction -- Construction and Protection Recommendations.
   1. The use of admixtures or antifreezes to lower the freezing point of mortar shall not be permitted.

C. In hot weather (above 99°F. with less than 50% relative humidity) protect masonry construction from direct exposure to sun and wind.

D. Temporary Bracing: Take adequate precautions to prevent damage to walls during erection by high winds or other forces. Where necessary, provide temporary bracing until the designed lateral strength is reached.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Brick Veneer: Basis of Design, Acme Brick Co. ASTM C 216 face brick or ASTM C 652 hollow brick.
1. Face Brick: ASTM C 216, Grade SW, Type FBS, face brick.
2. Hollow Brick: ASTM C 652, Grade SW, Class H40V, Type HBS, hollow brick with 3/4" minimum shell thickness on outer face shell, inner face shell, and end webs.
3. Brick Veneer "A" (4A-1): Crimson BL-3 Mod Vel
4. Brick Veneer “B” (4A-2): Doeskin
5. Brick Veneer “C” (4A-3) Glacier White

2.2 REINFORCING AND TIES

A. Wall Ties: ASTM A153
1. For Brick Veneer at CFS: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, hot-dip galvanized steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated screws and hot-dip galvanized steel ties/pintles of 3/16" diameter, with pintle length as required. Product/manufacturer; one of the following:
213 with 282; Heckman Building Products, Inc.
HB-213 with 2X Hook; Hohmann & Barnard, Inc.
2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)
2. For Brick Veneer at CMU: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, hot-dip galvanized steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated Tapcon screws and hot-dip galvanized steel ties/pintles of 3/16" diameter, with pintle length as required.. Product/manufacturer; one of the following:
213 with 282; Heckman Building Products, Inc.
HB-213 with 2X Hook; Hohmann & Barnard, Inc.
2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)
3. Wall Ties at ICF: Provide hot-dip galvanized at interior conditions and Type 304 stainless at exterior conditions. Product/manufacturer, or approved equivalent:
Thermal Concrete 2-Seal Wing Nut Anchor w/ 2X Hook; Hohmann & Barnard, Inc.
Contractor Option at Interior Locations Only:
Blok-Lok ICF Masonry Anchor (through-form) with Flex-O-Lok tie; Hohmann & Barnard, Inc.
4. For solid masonry, ties shall be 16 gage hot dip galvanized corrugated steel straps 7/8" wide x 7" long.
5. For glazed facing tile, ties shall be 10 gage hot dip galvanized steel wire loops or 18 gage galvanized corrugated steel straps.

B. Sound Absorbing Concrete Masonry Units (6C): Hollow units with solid closed top, fabricated from Portland cement and lightweight mineral aggregate, “Soundblox” Types 12" RSC/RF (8" RF and 4" RSC) as manufactured by the Proudfoot Company, Inc., Monroe, CT (phone 203.459.0031 web site: www.soundblox.com), providing a minimum NRC of 0.80.
1. All units shall be from the same manufacturing plant, shall have the same surface texture and shall meet the requirements of ASTM C 90, Grade N-I, moisture controlled, for load-bearing units.
2. Nominal Size: 8" x 16" face.
3. Sound Absorption: Two cavities with two funnel-shaped slots in each block. Each cavity shall have incombustible fibrous fillers with metal septa factory installed.
4. Provide left and right sound block units as required for reinforced masonry construction where shown on drawings.
5. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
6. Provide “equivalent concrete masonry thickness” required for fire-rated assemblies where required.

C. Joint Reinforcement at Single-wythe Concrete Masonry Unit: Provide truss type with continuous 9 gage diagonal cross rods spaced not more than 16" o.c., unless smaller spacing is shown on the drawings. Product/manufacturer; one of the following:
#120 Truss-Mesh; Hohmann & Barnard, Inc.
Series 300; Wire-Bond
1. Finish shall be Class 1 mill galvanized.
2. Corners and tees shall be prefabricated.

3. For Brick Veneer at CMU: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, hot-dip galvanized steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated Tapcon screws and hot-dip galvanized steel ties/pintles of 3/16" diameter, with pintle length as required.. Product/manufacturer; one of the following:
   213 with 282; Heckman Building Products, Inc.
   HB-213 with 2X Hook; Hohmann & Barnard, Inc.
   2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)

D. Joint Reinforcement for Masonry Veneer Not Laid in Running Bond: Provide ASTM A580, single 9 gage diameter hot dip continuous wire with rigid polyvinyl chloride seismic clip connector attached to masonry veneer wall tie/pintle. Provide seismic clip connector as manufactured by the following manufacturer or approved equivalent:
   "Seismiclip Interlock System" #187; Hohmann & Barnard, Inc.

E. Reinforcing Steel: ASTM A 615, Grade 60, deformed billet steel.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, domestic manufacture.
1. Provide white Portland cement for colored mortar and mortar used in laying glazed structural facing tile and glazed brick.
2. Provide natural Portland cement for other masonry.

B. Lime: ASTM C 207, Type S, with not more than 8% unhydrated oxides.

C. Aggregate for Mortar; Sand: ASTM C 144, well-graded natural sand. Provide white or light color sand for colored mortar and white mortar.

D. Aggregate for Grout: ASTM C 404.

E. Water: Clean and free of deleterious amounts of acids, alkalis, or organic materials.

F. Water-repellent Admixture: Provide same integral liquid polymeric water repellent admixture used in split-faced and burnished concrete masonry units for mortar used in laying split-faced and burnished concrete masonry units.

2.4 MORTAR

A. Mix proportions: ASTM C 270, mortar proportions by volume:
1. Type N Mortar - Exterior and Interior at masonry veneer construction:
   1 part Portland cement
   1 part lime
   6 parts sand
   Coloring Pigment: Add coloring pigment at manufacturer's recommended rate to obtain custom blended colors as selected by Architect. No mortar color is required at concealed or painted masonry.
2. Type M Mortar - Exterior masonry veneer construction below grade or in contact with earth:
   1 part Portland cement
   1/4 part lime
   3-3/4 parts sand
3. Type S Mortar - Exterior and Interior at load-bearing and non-load-bearing concrete masonry unit walls:
   1 part Portland cement
   1/2 part lime
   4-1/2 parts sand
   Coloring Pigment: Add coloring pigment at manufacturer's recommended rate to obtain custom blended colors as selected by Architect. No mortar color is required at concealed or painted masonry.
4. Bedding Mortar:
   1 part Portland cement
   1/7 part lime
   3 parts sand

B. Mixing:
1. All dry material shall be accurately measured in a leak-proof batching box. Contractor shall have the option of using a pre-manufactured cubic foot batching box or fabricating a wood box for measuring dry materials by volume. Box may be a convenient size, but shall be not less than 12" x 12" x 12" inside dimensions. The use of shovels for measuring dry materials is strictly prohibited.
2. Proportion mortar accurately and mix thoroughly with the maximum amount of water to produce a workable consistency for at least 5 minutes in a mechanical batch mixer. Keep tools and mixing equipment clean.
3. Do not use mortar which has begun to set, or if more than 2½ hours have elapsed since initial mixing. Do not re-temper mortar.
4. Mortar for Split-face, Smooth-face, and Burnished Concrete Masonry Units: Add water repellent admixture at manufacturer's recommended rates to ensure mortar will be permanently water repellent.

C. Use: Lay exterior and interior masonry veneer construction using Type N mortar. Lay exterior masonry veneer below grade or in contact with earth using Type M mortar. Lay exterior and interior load-bearing masonry using Type S mortar. Where required use bedding mortar to set and fill hollow metal frames.

D. Masonry cement is not acceptable for mortar.

E. Do not use calcium chloride in mortar.

F. Pre-mix, dry or wet, is not acceptable for mortar, except as listed below; i.e. no other pre-mix mortars are acceptable.

2.5 GROUT

A. Grout shall conform to ASTM C 476. Provide grout for bond beams, masonry lintels, and reinforced masonry.
1. Fine Grout Proportions:
1 part Portland cement
1/10 part lime
3 parts fine aggregate
2. Coarse Grout Proportions
1 part Portland cement
1/10 part lime
3 parts fine aggregate
2 parts coarse aggregate

B. When placing grout in masonry, exercise extreme care to prevent grout from staining face of masonry.

2.6 GROUT; PRE-BLENDED

A. Contractor's Option: Provide pre-blended grout mix as manufactured by SPEC MIX, Inc. (phone 888.773.2649 web site: www.specmix.com), instead of field-prepared grouts, NO SUBSTITUTIONS. SPEC MIX pre-blended grout option shall include manufacturer's standard silo system for mixing and delivery of grout mixes.
1. Equivalent products by Quikrete Cement and Concrete Products–Dallas (800.627.6125) will be considered acceptable.
2. Pre-blended grout mixes shall be mixed with potable water in strict compliance with manufacturer's written instructions and recommendations.

B. SPEC MIX Core Fill Masonry Grout:
1. Material: Pre-blended factory mix of cementitious materials and dried aggregates meeting ASTM C 476 requirements for reinforced masonry construction.
2. SPEC MIX Core Fill - Fine Grout: Pre-blended mix containing cementitious materials and fine aggregate designed to fill masonry voids two inches or less.
3. SPEC MIX Core Fill - Course Grout: Pre-blended mix containing cementitious materials and coarse aggregate designed to fill masonry voids greater than two inches.

C. Mixing: Mix grout using manufacturer's standard mechanical mixer to ensure homogeneity and workability. Observe mixing time of 5 minutes, consistent from batch to batch. Use clean, potable water; add the maximum amount consistent with optimum workability.
1. Discard unused grout 1.5 hours after initial mixing.

2.7 BRICK CLEANER

A. Use "Sure-Klean Vana Trol" as manufactured by ProSoCo, Inc., or an approved equivalent inorganic commercial masonry surface cleaner. "Sure Klean 600" may be used at concrete masonry units which are not adjacent to colored mortar and concrete masonry units which are scheduled to be painted.

2.8 ACCESSORIES

A. Control Joints: Preformed rubber material; RS Series Rubber Control Joint as manufactured by Hohmann & Barnard, Inc. or comparable products by Heckman. Width slightly less than wall thickness to allow for sealant material.

B. Cellular Plastic Weeps: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8" less than depth of outer wythe. Product/manufacturer; one of the following:
Mortar Maze weep vent; Advanced Building Products Inc.
No. 85 Cell Vent; Heckmann Building Products Inc.
Quadro-Vent; Hohmann & Barnard, Inc.
Cell Vent; Wire-Bond

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the cavity. Provide strips, full-depth of cavity, 10 inches high, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings. Product/manufacturer; Mortar Net™ with Insect Barrier, Mortar Net USA, Ltd. (phone 800.664.6638 web site: www.mortarnet.com).
1. 0.4” thick Mortar Net between back of brick and steel lintels, cut down to required height.
2. Provide single thickness 2” material at 1-3/4” to 2-1/4” wide masonry cavities.

D. Joint Stabilization Anchors: Mill-galvanized. Product/manufacturer:
Slip-set Stabilizer; Hohmann and Barnard

PART 3 - EXECUTION

3.1 PREPARATION

A. Wetting of Face Brick:
1. Draw a 1" circle with wax crayon on the bed surface of dry brick. Using medicine dropper, place 20 drops of water inside circle and measure time required for absorption of water.
2. If water is absorbed in less than 11/2 minutes, brick must be wet before being laid.
3. Brick shall have no visible moisture when laid.

B. Cleaning: Beams, slabs, and lintels on which masonry walls and partitions are to be laid shall be brushed thoroughly to remove loose dirt and laitance.

3.2 INSTALLATION

A. Installation Tolerances:
1. Maximum Variation from Plumb:
a. Vertical lines and surfaces of columns and walls:
1) 1/4" in 10'-0".
2) 3/8" in any story or 20'-0" maximum.
3) 1/2" in 40'-0".
b. External Corners or Control Joints:
1) 1/4" in any one story or 20'-0" maximum.
2) 1/2" in 40'-0".
2. Maximum Variation from Unit to Adjacent Unit: 1/32" maximum. Maximum variation is mandatory on walls where only one surface is exposed. Where two surfaces are exposed to view, the more prominent face, per Architect, is to have maximum variation maintained, with the less prominent face allowed to exceed the maximum tolerance.
3. Maximum Variation from Level or Grades for Exposed Lintels, Sill, Parapets, or Horizontal Grooves:
a. 1/4" in any bay or 20'-0" maximum.
b. 1/2" in 40'-0".

4. Maximum Variation from Plan Location or Linear Building Line or Related Portions of Columns, Walls, and Partitions:
   a. 1/2" in any bay or 20'-0" maximum.
   b. 3/4" in 40'-0".
5. Maximum Variation in Cross-sectional Dimension of Columns and Thickness of Walls: ±1/4.
6. Maximum Variation in Mortar Joint Thickness:
   a. Bed Joint: ±1/8".
   b. Head Joint: ±1/8".

B. Laying Brick: Lay brick level, plumb, straight, and true to line within tolerances specified above. Spread the mortar bed full width and relatively smooth. Do not furrow. Butter the end of each brick with mortar and shove into place to completely fill the head joint. Do not feather the brick with excess mortar cut from the bed.
   1. At concrete foundations and beams, install bond breaker between first course of brick veneer and concrete bearing. Gaskets at bottom of cavity walls shall not be used as bond breakers unless gasket occurs under the first course of brick.
   2. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units to provide patterns shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Remove cut misfits and replace with properly cut units.
   3. Lay brick with special coursing and jointing as detailed. Lay rowlock and soldier courses with uniform joints approximately 3/8" wide. Use uncored brick for the exposed ends of such courses and wherever the holes would be exposed.
   4. When laying walls, keep the air space free and clear of mortar droppings and debris.
   5. Unless shown otherwise, provide vertical control joints every 40'.
   6. Refer to Expansion Joint Paragraph for Expansion Joints (Control Joints).

C. Laying Concrete Masonry Units: Spread mortar beds smooth and full to cover bearing areas. Do not furrow. Butter head joints and shove units into place. Head joints shall be staggered except where stack bond is specifically indicated. Make back joints full against the backing materials as each course is laid.
   1. Leave pipe spaces open on one full side until pipe work has been completed and inspected.
   2. Lay concrete masonry walls and partitions level, plumb, straight, and true to line within tolerances specified above.
   3. Fill the cells of exposed concrete masonry units with grout for a width of 8" at the jambs of openings in exterior walls.
   4. Exposed ends of units at external corners shall be solid.
   5. Units shown to be laid in stack bond shall be laid with such accuracy that a plumb line centered on a vertical joint in an upper course will be entirely within the width of the corresponding vertical joint in every lower course.
   6. Unless shown otherwise, provide vertical control joints every 40'.
   7. At sound absorbing concrete masonry units, provide slip-set stabilizer at 16" o.c., vertically,
   8. Maximum pour of grout in vertical cells shall be limited to 5'-0" unless cleanouts are provided at each cell.

D. Installation of Reinforced Unit Masonry:
   1. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
      a. Construct formwork to conform to shape, line, and dimensions shown. make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
      b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
   2. Set reinforcing in required position and secure against displacement before grouting is started. Cells requiring vertical reinforcement and grout shall be aligned to provide continuous unobstructed vertical opening. Place vertical reinforcing in cells with enough steel extending to provide proper lap splice. Horizontal steel shall be fully embedded in grout.
   3. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
      a. Do not exceed the following pour heights for fine grout.
         1) For minimum widths of the grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches, pour height of 12 inches.
         2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 60 inches.
         3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.

4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 24 feet.

b. Do not exceed the following pour heights for coarse grout.
1) For minimum widths of the grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.
4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.

4. Provide cleanout holes at least 3 inches in least dimension for grout pours over 60 inches in height. Cleanouts shall be sealed after inspections before grouting.
a. Provide cleanout holes at each vertical reinforcing bar.
5. Place grout in lifts not exceeding 5 feet.
6. Consolidate grout at the time of initial placement.
7. Grouting of a section of wall shall be completed within one day with no interruptions greater than one hour.

E. Reinforcing Masonry Joints: Reinforce the bed joints of concrete masonry unit walls and partitions with continuous joint reinforcement strips.
1. Furnish strips in long lengths. Width of strips shall be 2" less than nominal overall width of the wall or partition.
2. Lap strip ends 12" and bed side rods in mortar for complete cover and bond.
3. Install strips in bed joints spaced 16" o.c. for exterior walls and 24" o.c. for interior partitions, unless a smaller spacing is shown in the drawings. Reinforcement shall extend into and bond the facing wythe in walls.

F. Bonding: Tie together masonry unit construction within walls and at intersections of walls by masonry bond and staggered vertical joints. Toothing will not be permitted except where specifically authorized by the Architect. Where walls must be built in advance of adjacent walls, form the stop-off by racking back.
1. Lay brick facing wythe in standard running bond with staggered head joints except where special coursing is indicated. Tie multiple wythe construction together with horizontal joint reinforcement and tab ties.
2. Where bond with joint reinforcement cannot be made, use wall ties spaced not more than 16" o.c. horizontally and vertically. Ties shall be laid in the joints, not shoved into wet mortar after setting the next course of masonry.
3. Tie brick veneer back to steel stud curtain walls and concrete unit masonry with metal ties spaced 16" o.c. horizontally and 16" o.c. vertically. Around the perimeter of openings, edges, and tops and bottoms of walls, additional ties/anchors shall be installed at a maximum of 3 ft. o.c. within 12" of the opening. Secure ties through the sheathing to the studs with two screws and insert ties.
a. Secure wall tie backplates with fasteners that are wet-set with sealant compatible with the air- and water-resistive barrier system.
4. Tie masonry to structural steel columns by welding anchors to columns at 16" o.c. and inserting triangular ties. Ties shall be of the size required to extend a minimum of 1-1/2” into brick veneer, with a minimum mortar cover of 5/8” to the outside face of the veneer.
5. Where concrete is faced more than 12" high with masonry, bond masonry to concrete with anchors set into dovetail anchor slots cast into the concrete. Provide the anchors. Spacing shall be as specified above for wall ties.
6. Bond interior masonry walls and the intersection of interior/exterior masonry walls by forming control joints and reinforce with horizontal reinforcing at 16" o.c.
7. Partitions between rooms without suspended ceilings, and 4" thick partitions with an unsupported length of more than 12 ft. shall be extended to the floor or roof above and wedged and sealed against it. Extend other partitions above the highest adjacent ceiling, unless indicated to extend up to floor or roof above.

G. Joints shall be 3/8" wide. Joints shall be straight and uniform.
1. Tool and work exposed joints to a hard, dense surface with a sled runner and leave without shrinkage cracks. Delay tooling until the mortar has set thumbprint hard. Tool the joints in masonry walls behind chalkboards and tackboards.
2. Rake out the joints to be caulked and keep them free of mortar as the work progresses.
3. Provide control joints at inside corners with backer rod and sealant.
4. Mortar color changes: Location of mortar color changes in relation to masonry color changes shall be as directed by Architect. Contractor shall rake and point mortar joints or otherwise alter standard masonry procedures to satisfy this requirement.

H. Masonry Bearings: Provide bearings of common brick under framing members which bear on masonry walls unless the members bear directly on concrete-filled bond beams.

I. Chases: Form chases and recesses to the required dimensions and lines, strike joints flush and remove excess mortar. Before closing chases and similar inaccessible spaces with masonry, remove rubbish and sweep out the area.

J. Lintels and Beams: Provide lintels and beams for openings in masonry walls. This includes lintels at masonry openings for ducts. Verify duct layouts on the mechanical drawings.
   1. Reinforced Masonry Lintels: Construct and reinforce masonry lintels where shown.
      a. Make concrete masonry lintel units of the same material and by the same process as the other concrete masonry units used in the building.
      b. Use trough-type units, not regular units with the web knocked out. Fill the troughs with grout.
      c. Build lintels in place where possible and cure at least 14 days before subjecting them to load. Provide at least 8" bearing at each jamb.
      d. Where reinforcing is not specifically called out for masonry lintels, use not less than a #4 bar top and bottom of 8" high masonry units for each 4" thickness of wall.
   2. Bond Beams: Provide bond beams in masonry walls. Bond beams shall be continuous where possible. Provide rebar positioners to accurately position reinforcing steel.
   3. Steel Lintels: Build steel lintels into the masonry walls. Where reinforcing or steel shapes are not specifically called out for lintels in brick walls, use one steel angle for each 4" thickness of brick in the wall.

K. Flashing:
   1. Build in flashings which enter the masonry, using the materials and following the instructions of the pertinent sections of the specifications.
   2. Create end dams at ends of window heads, at edges of storefronts, and other vertical elements to channel water to nearest weep hole away from window mullions and other items which might allow water to travel vertically.

L. Weeps: Install weep holes in veneer at 24" o.c. horizontally for clay masonry and 32" o.c. for 16" long concrete masonry, above through-wall flashing, above shelf angles, and at top and bottom of walls. Install plastic weeps in strict accordance with manufacturer’s written instructions and recommendations.

M. Cavity Drainage Material: Install cavity drainage material in cavities to comply with manufacturer’s written instructions and recommendations. Provide single thickness 2” material at 1-3/4” to 2” wide masonry cavities. Provide one or more thicknesses as required to fill cavity width at other conditions. Install cavity drainage material with fabric facing to the exterior of the wall.

N. Expansion Joints (Control Joints):
   1. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.
   2. At interior masonry walls and intersection of interior/exterior masonry walls, continue horizontal joint reinforcement across control joints.
   3. Provide resilient continuous lengths of control joint material in concrete masonry unit sash blocks. Solvent weld butt and corner joints, in accordance with manufacturer's instructions.
   4. Size control joints in accordance with SECTION 07 92 00 - JOINT SEALANTS, for sealant performance, but in no case larger than adjacent mortar joints in exposed face brick.
   5. Reference SECTION 07 95 00 - EXPANSION CONTROL for Preformed, Foam Joint Seals PJS-1.
   6. Interior control joints are not required to align with exterior control joints.
   7. Provide vertical expansion joints in masonry (concrete masonry unit and brick), as follows:
      a. Where shown on drawings.
      b. Horizontal expanse:
         1) Brick: 25’-0” max.
         2) Concrete Masonry Units: Not to exceed a length to height ratio of 1-1/2 : 1 or 25 ft., whichever is less.
      c. Within 2'-0" of inside corners.
      d. Change of substrate including but not limited to the following:
         1) Concrete masonry unit to metal stud back-up.
         2) In masonry wall at intersection of concrete beam supported masonry and structural steel supported masonry.
      e. As recommended by referenced standards.
   8. Control joints shall extend continuous through bond beam although concrete and reinforcement for bond beam shall extend continuous through control joint.

O. Built-in Work:
1. As work progresses, build-in metal door frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the work supplied by other sections.
2. Build-in items plumb and level.
3. Bed anchors of metal door and glazed frames in mortar joints. Fill frame voids solid with mortar. Fill masonry cores with mortar minimum 8" from framed openings.
4. Do not build-in organic materials subject to deterioration.

P. Cutting and Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other sections of work to provide correct size, shape, and location.
2. Obtain approval prior to cutting or fitting an area not indicated or where appearance or strength of masonry work may be impaired.

Q. Miscellaneous Work:
1. Cooperate with other trades in installing their work in masonry. Furnish bedding mortar and set loose lintels. Cooperate in setting bucks and frames, maintain them in position and build them in with anchors properly placed. Do not distort frames by crowding.
2. Cut and form openings for recessed items and for electrical and plumbing installations so that wall plates and escutcheons will completely cover the openings. Cut edges shall be clean, sharp and straight.
3. Fill solid with mortar the spaces around and behind metal door frames.
4. Point with mortar the openings around flush-mounted electrical outlet boxes.

R. Curing: In dry weather, masonry exposed to wind and sun shall be wet with a fine water spray several times each day for at least 6 days, starting as soon as the mortar has set sufficiently to resist erosion.

S. Non-load-bearing Concrete Masonry Unit Partitions: Partitions which extend up to structure above for fire, acoustical, or security reasons, shall terminate within 2" of structural deck, joists or beams to allow for deflection. Fill 2" gap with sealant and fire safing to achieve proper rating.

T. Sound-conditioned Masonry Walls: Fill cells of concrete masonry walls scheduled to be sound conditioned with grout.
1. Grouted masonry walls shall be covered with plastic sheeting secured with Hohmann & Barnard, Inc. Masonry Wall Clamp No. HB3000. Grout must be completely dry when wall is finished and enclosed.
2. At the end of each day's work, cover the tops of grouted masonry walls and other unfinished exposed cavity wall openings with secured plastic sheeting.

3.3 PROTECTION

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Maintain protective boards at exposed external corners which may be damaged by construction activities.

C. Provide protection without damaging completed work.

D. At the end of each day's work, cover the tops of masonry walls, window sills and jambs, door jambs, and other unfinished exposed cavity wall opening with plastic sheeting or other suitable material. Cover shall extend a minimum of 2' down both sides of walls and shall be held securely in place with Hohmann & Barnard, Inc. Masonry Wall Clamp No. HB3000.

E. Keep expansion joint voids clear of mortar.

3.4 POINT AND CLEAN

A. Pointing: Upon completion of the masonry work, fill and neatly point line nail holes and other defects. Remove mortar droppings from projecting surfaces.

B. Cleaning:
1. Clean face brick with a commercial cleaner. Test the cleaner on an inconspicuous area of face brick to insure that it performs as intended without leaving scum or residue. Before the solution is applied, soak the brick surface with clean water. Apply the cleaner in accordance with the manufacturer's instructions and rinse the surface thoroughly with clean water to remove traces of the cleaner. Protect metal and concrete surfaces from contact with the cleaner.
2. Clean glazed facing tile with brushes and clean water. Use no acids or abrasives.
3. Clean exposed concrete masonry units by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

C. Cleaning Existing Masonry:
1. Where existing masonry is scheduled to be cleaned, use high pressure water cleaning equipment with nozzle pressures between 400 psi and 700 psi and a flow rate of 3 to 8 gallons per minute.
2. Select and test recommended cleaning solution on a sample area.
3. Protect metal, glass, and wood by masking or other methods, as approved by Architect.
4. Presoak or saturate area to be cleaned by flushing with clean water from the top down.
5. Apply cleaning solution to wall.
6. Starting at the top of the wall, flush the wall down.
7. Repeat process as required for proper cleaning.

3.5 FIELD QUALITY CONTROL

A. General: Owner will employ services of an independent materials testing laboratory to perform specified inspections and testing.

B. Coordinate with Owner’s testing laboratory to provide PERIODIC inspection of the following tasks:
1. As masonry construction begins, and every 5000 sq. ft. during construction, the following shall be verified to ensure compliance:
   a. Proportions of site prepared mortar.
   b. Construction of mortar joints.
   c. Location of reinforcement and connectors.
2. During construction, the inspection program shall verify:
   a. Size and location of structural elements.
   b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
   c. Specified size, grade, and type of reinforcement and anchor bolts.
   d. Protection of masonry during cold weather (temperature below 40°F.) or hot weather (temperature above 90°F.).
3. Prior to grouting at interior non-load-bearing partitions shown in the Architectural drawings, the following shall be periodically verified to ensure compliance:
   a. Grout space is clean.
   b. Placement of reinforcement and connectors.
   c. Proportions of site-prepared grout.
   d. Construction of mortar joints.

C. Coordinate with Owner’s testing laboratory to provide CONTINUOUS inspection of the following tasks:
1. Prior to grouting at masonry walls shown on the Structural Drawings, the following shall be continuously verified to ensure compliance:
   a. Grout space is clean.
   b. Placement of reinforcement and connectors.
   c. Proportions of site-prepared grout.
   d. Construction of mortar joints.
   e. Grout placement shall be verified to ensure compliance with code and construction document provisions.

END OF SECTION

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SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete unit masonry construction.

B. Related Requirements:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 05 50 00 - Metal Fabrications: steel lintels.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
4. Section 07 65 00 - Flexible Flashing; through-wall flashing for masonry walls.
5. Section 07 21 00 - Building Insulation: continuous insulation.
6. Section 07 92 00 - Joint Sealants.
7. Section 08 11 00 - Hollow Metal Doors and Frames; installation of steel frames.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Test Reports: Manufacturer of the concrete masonry units shall submit:
1. Certified test reports showing that the units to be furnished meet the requirements of ASTM C 90 and C 129, and have the required minimum compressive strengths.
2. Reports certifying concrete masonry units meet or exceed each of the fire resistive ratings.

C. Provide a diagram of proposed control joints and expansion joints.

D. Submit steel reinforcing shop drawings for load-bearing concrete masonry unit walls, including elevations showing reinforcing, control joints, bond beams, dimensions and details.

E. Mortar Mixture Proportions: ASTM C 270, Submit copies of each proposed mix design for review prior to starting masonry work.

F. Grout Mixture Proportions: ASTM C 476, Submit copies of each proposed mix design for review prior to any grout placement.
1. Include recent historical grout cylinder strength test reports for each mix design.

G. Pre-blended Mortar and Grout Certificates: Submit manufacturer’s certificates that products meet or exceed specified requirements.
1. Mortar: Submit test reports, per ASTM C 780, for each mortar mix indicating strength of mortar mixes. Submit computer batch-ticket to confirm the mixes meet the project SPEC MIX specifications for every 3,000-pound bulk bag of mortar.
2. Grout: Submit test reports, per ASTM C1019, for each grout mix indicating compressive strengths. Submit computer batch-ticket to confirm the grout mixes meet the project SPEC MIX specifications for every 3,000-pound bulk bag of grout.

1.3 QUALITY ASSURANCE

A. Manufacturer: Manufacturer shall have a minimum of 5 years’ experience manufacturing the specified product.

B. Installer: Masonry contractor shall have a minimum of 5 years’ experience in similar types of work and be able to furnish a list of previous jobs and references if requested by the Architect.

C. Pre-installation Conference: Contractor shall schedule pre-installation conference at the project site with Architect/Engineer and Owner's Testing Lab. Conference shall be held prior to proceeding with masonry work and shall comply with requirements in Division 01 Section "Project Management and Coordination”.

D. Mock-up: Construct a sample wall panel at the site using concrete masonry units, mortar, and masonry backup proposed for the project. The panel shall duplicate the typical building wall construction (coursing, bonding, joint treatment, sealant, cleaning methods and materials as required in SECTION 07 92 00 - JOINT SEALANTS). Sample panel shall be fully acceptable to the Architect prior to ordering of materials. Install one vertical 3/8" control joint for full height of panel. Panel shall be not less than 4 ft. by 3 ft. Construct panel on a wood pallet, providing portability around the project site. Do not alter nor destroy mock-up until attainment of Substantial Completion. Approved mock-up panel shall be the standard of comparison for workmanship and materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units above ground on wood pallets which allow air circulation under the stacked units.

1.5 PROJECT CONDITIONS

A. Refer to "Protection" Paragraph for daily activities.

B. Cold Weather Construction: Do no masonry work when freezing weather is expected. If Contractor elects to lay masonry when air temperature falls or is expected to fall below 40°F., provide construction means and protection of completed masonry as described in BIA Technical Note 1A Cold Weather Masonry Construction -- Construction and Protection Recommendations.
1. The use of admixtures or antifreezes to lower the freezing point of mortar shall not be permitted.

C. In hot weather (above 99°F. with less than 50% relative humidity) protect masonry construction from direct exposure to sun and wind.

D. Temporary Bracing: Take adequate precautions to prevent damage to walls during erection by high winds or other forces. Where necessary, provide temporary bracing until the designed lateral strength is reached.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Concrete Masonry Units: ASTM C 90, Grade N-I, moisture controlled, for load-bearing units; ASTM C 129, moisture controlled, Type I, for non-load-bearing units. Provide hollow units made from Portland cement and lightweight mineral aggregate.
1. All units shall be from the same manufacturing plant and shall have the same surface texture.
2. Use load-bearing units for exterior wall backup and load-bearing partitions, non-load-bearing units elsewhere.
3. Provide 1" bullnose units at exposed outside corners and jambs and as noted on drawings.
   a. Provide square edge starter course corners at all rubber base conditions where preformed base corners are specified to be provided.
   b. Provide square edges at all furred units and units to be covered with ceramic tile.
4. Provide sash block control joints at all concrete block walls with H&B #VS pre-molded PVC control joint filler.
5. Provide 5" starter blocks where required.
6. Nominal Size: 8" x 16" face.
7. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.

B. Concrete Building Brick: ASTM C 55.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi.
2. Weight Classification: Lightweight.
3. Size (Actual Dimensions): 3-5/8" wide by 3-5/8" high by 7-5/8" long.

C. Smooth-Face Concrete Masonry Units: Provide Featherlite smooth-faced concrete masonry units, color as selected by Architect [color as scheduled],7-5/8 x 7-5/8” x 15-5/8” units. All exposed edges shall match face. Smooth-face concrete masonry units shall be manufactured with Dry-Block admixture as manufactured by W.R. Grace & Co. Equivalent products by Headwaters Construction Materials will be acceptable.
1. Provide factory-applied clear satin gloss acrylic finish on exposed faces.

D. Related Materials:
1. Bond Breaker: ASTM D 226, Type I (No. 15), non-perforated asphalt-saturated felt.

2.2 REINFORCING AND TIES

A. Triangular Ties and Column Anchors: ASTM A 82 galvanized steel wire, 3/16" diameter ties and ¼" diameter anchors, for tying masonry walls to steel columns.

B. Dovetail Anchors: 16 gage hot dip galvanized corrugated steel ties 1" wide x 4 1/2" long.

C. Joint Reinforcement at Single-wythe Concrete Masonry Unit: Provide ladder type with continuous 9 gage ladder side and cross rods spaced not more than 16" o.c. and welded, unless smaller spacing is shown on the drawings. Product/manufacturer; one of the following:
#220 Ladder-Mesh; Hohmann & Barnard, Inc.
Series 200 Ladder Mesh; Wire-Bond
1. Finish shall be Class 1 mill galvanized.
2. Corners and tees shall be prefabricated.

D. Wall Ties for CMU Veneer at CMU Backup: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, hot-dip galvanized steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated screws and hot dip galvanized steel ties/pintles of 3/16" diameter, with pintle length as required. Product/manufacturer; one of the following:
213 with 282; Heckman Building Products, Inc.
HB-213 with 2X Hook; Hohmann & Barnard, Inc.
2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)

A. Joint Reinforcement at Multi-wythe Concrete Masonry Unit: Provide ladder type with continuous 9 gage sid and cross rods spaced not more than 16" o.c. and welded, unless smaller spacing is shown on the drawings. Product/manufacturer; one of the following:
#270-2X Ladder Eye-Wire; Hohmann & Barnard, Inc.
Series 800 Ladder; Wire-Bond
1. Finish shall be hot-dip galvanized.
2. Corners and tees shall be prefabricated.

B. Joint Reinforcement at Multi-wythe Concrete Masonry Units: Truss design with continuous 9 gage side rods and 9 gage diagonal cross rods spaced not more than 16" o.c., unless smaller spacing is shown on the drawings, #140 Truss-Twin-Mesh as manufactured by Hohmann & Barnard, Inc. or approved equivalent.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed billet steel.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, domestic manufacture, natural Portland cement. Provide white Portland cement for colored mortar and white mortar.

B. Lime: ASTM C 207, Type S, with not more than 8% unhydrated oxides.

C. Aggregate for Mortar; Sand: ASTM C 144, well-graded natural sand. Provide white or light color sand for colored mortar and white mortar.

D. Aggregate for Grout: ASTM C 404.

E. Water: Clean and free of deleterious amounts of acids, alkalis, or organic materials.

F. Coloring Pigment: Custom mortar color as selected by Architect to match Face Brick Type A (Field Brick) and Type B (Accent Brick). Provide coloring pigment as manufactured by Lambert Southwest, Inc., (phone 903.657.4680 web site: www.lambertsw.com) or Solomon Colors (phone 800.624.0261 web site www.solomoncolors.com).

G. Water-repellent Admixture: Provide same integral liquid polymeric water repellent admixture used in split-faced and burnished concrete masonry units for mortar used in laying split-faced and burnished concrete masonry units.

2.4 MORTAR; FIELD PREPARED

A. Mix proportions: ASTM C 270, mortar proportions by volume:
1. Type N Mortar - Exterior and Interior at masonry veneer construction:
1 part Portland cement
1 part lime
6 parts sand

B. Mixing:
1. All dry material shall be accurately measured in a leak-proof box. Contractor shall have the option of using Mix-Rite as manufactured by Gibco (phone 800.822.0802); VOL-CON as manufactured by Vol-Con, Inc. (phone 319.383.1856); or fabricating a wood box for measuring dry materials. Box may be any convenient size, but shall be not less than 12" x 12" x 12" inside dimensions. The use of shovels for measuring dry materials is strictly prohibited.
2. Proportion mortar accurately and mix thoroughly with the maximum amount of water to produce a workable consistency for at least 5 minutes in a mechanical batch mixer. Keep tools and mixing equipment clean.
3. Do not use mortar which has begun to set, or if more than 2-1/2 hours have elapsed since initial mixing. Do not re-temper mortar.
4. Mortar for Split-face, Smooth-face, and Burnished Concrete Masonry Units: Add water repellent admixture at manufacturer's recommended rates to ensure mortar will be permanently water repellent.

C. Use: Lay exterior and interior masonry veneer construction using Type N mortar. Lay exterior and interior load-bearing masonry using Type S mortar. Where required use bedding mortar to set and fill hollow metal frames.

D. Masonry cement is not acceptable for mortar.

E. Do not use calcium chloride in mortar.

F. Pre-mix, dry or wet, is not acceptable for mortar, except as listed below; i.e. no other pre-mix mortars are acceptable.

2.5 MORTAR; PRE-BLENDED MORTAR MIXES, COLORED MORTAR MIXES, AND INTEGRAL WATER REPELLENT MORTAR MIXES

A. Contractor's Option: Provide pre-blended mortar mix, colored mortar mix, and integral water repellent mortar mix as manufactured by SPEC MIX, Inc. (phone 888.329.7732 web site: www.specmix.com), instead of field-prepared mortars, NO SUBSTITUTIONS. SPEC MIX pre-blended mortar option shall include manufacturer's standard silo system for mixing and delivery of mortar mixes.
1. Equivalent products by Quikrete Cement and Concrete Products–Dallas (800.627.6125) will be considered as acceptable.
2. Pre-blended mortar mixes shall be mixed with potable water in strict compliance with manufacturer's written instructions and recommendations.
3. Masonry cement is not acceptable for pre-blended mortar.

B. SPEC MIX PCL Sand Pre-blended Mortar Mix:
1. Material: Pre-blended factory mix of Portland cement, hydrated lime and sand aggregate mixtures.
2. Mortar Type: Property mixture Type S for exterior and Interior at load-bearing masonry walls and Type N for exterior and Interior masonry veneer construction.

C. SPEC MIX PCL Sand Pre-blended Colored Mortar Mix:
1. Material: Pre-blended factory mix of Portland cement, hydrated lime, sand aggregate, and color pigments.
2. Mortar Type: Property mixture Type S for exterior and Interior at load-bearing masonry walls and Type N for exterior and Interior masonry veneer construction.

D. SPEC MIX PCL Sand Pre-blended IWR Colored Mortar Mix:
   1. Material: Pre-blended factory mix of Portland cement, hydrated lime, sand aggregate, color pigments, and incorporating dry SPEC MIX Integral Water-repellent Mortar Admixture.
   2. Mortar Type: Property mixture Type S for exterior and Interior at load-bearing masonry walls and Type N for exterior and Interior masonry veneer construction.

E. Mixing: Mix mortar using manufacturer's standard mechanical mixer to ensure homogeneity and workability. Observe mixing times of 4-5 minutes, consistent from batch to batch. Use clean, potable water; add the maximum amount consistent with optimum workability.
   1. At the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.
   2. Discard mortar 2.5 hours after initial mixing.

2.6 GROUT; FIELD PREPARED

A. Grout shall conform to ASTM C 476. Provide grout for bond beams, masonry lintels, and reinforced masonry.
   1. Fine Grout Proportions:
      1 part Portland cement
      1/10 part lime
      3 parts fine aggregate
   2. Coarse Grout Proportions
      1 part Portland cement
      1/10 part lime
      3 parts fine aggregate
      2 parts coarse aggregate

B. When placing grout in masonry, exercise extreme care to prevent grout from staining face of masonry.

2.7 GROUT; PRE-BLENDED

A. Contractor's Option: Provide pre-blended grout mix as manufactured by SPEC MIX, Inc. (phone 888.329.7732 web site: www.specmix.com), instead of field-prepared grouts, NO SUBSTITUTIONS. SPEC MIX pre-blended grout option shall include manufacturer's standard silo system for mixing and delivery of grout mixes.
   1. Equivalent products by Quikrete Cement and Concrete Products–Dallas (800.627.6125) will be considered as acceptable.
   2. Pre-blended grout mixes shall be mixed with potable water in strict compliance with manufacturer's written instructions and recommendations.

B. SPEC MIX Core Fill Masonry Grout:
   1. Material: Pre-blended factory mix of cementitious materials and dried aggregates meeting ASTM C 476 requirements for reinforced masonry construction.
   2. SPEC MIX Core Fill - Fine Grout: Pre-blended mix containing cementitious materials and fine aggregate designed to fill masonry voids two inches or less.
   3. SPEC MIX Core Fill - Course Grout: Pre-blended mix containing cementitious materials and coarse aggregate designed to fill masonry voids greater than two inches.

C. Mixing: Mix grout using manufacturer's standard mechanical mixer to ensure homogeneity and workability. Observe mixing time of 5 minutes, consistent from batch to batch. Use clean, potable water; add the maximum amount consistent with optimum workability.
   1. Discard unused grout 1.5 hours after initial mixing.

2.8 MASONRY CLEANER

A. Use "Sure Klean 600" at concrete masonry units which are not adjacent to colored mortar and concrete masonry units which are scheduled to be painted.

2.9 ACCESSORIES

A. Control Joints: Preformed rubber material; RS-Standard Rubber as manufactured by Hohmann & Barnard, Inc. or comparable products by Heckman. Width slightly less than wall thickness to allow for sealant material.

B. Joint Sealant: Refer to SECTION 07 92 00 - JOINT SEALANTS.

C. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.

D. Cellular Plastic Weeps: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8" less than depth of outer wythe. Product/manufacturer; one of the following:
Mortar Maze weep vent; Advanced Building Products Inc.
No. 85 Cell Vent; Heckmann Building Products Inc.
Quadro-Vent; Hohmann & Barnard, Inc.
Cell Vent; Wire-Bond

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the cavity. Provide strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings. Product/manufacturer; Mortar Net™ with Insect Barrier, Mortar Net USA, Ltd. (phone 800.664.6638 web site: www.mortarnet.com).

F. Rebar Positioners: Size and type required to accurately place reinforcing steel in bond beams, concrete masonry unit lintels and vertically in walls.

G. Joint Stabilization Anchors: Mill-galvanized. Product/manufacturer:
1. Slip-set Stabilizer; Hohmann and Barnard

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning: Beams, slabs, and lintels on which masonry walls and partitions are to be laid shall be brushed thoroughly to remove loose dirt and laitance.

3.2 INSTALLATION

A. Installation Tolerances:
1. Maximum Variation from Plumb:
a. Vertical lines and surfaces of columns and walls:
1) ¼" in 10'-0".
2) ⅜" in any story or 20'-0" maximum.
3) ½" in 40'-0".
b. External Corners or Control Joints:
1) ¼" in any one story or 20'-0" maximum.
2) ½" in 40'-0".
2. Maximum Variation from Unit to Adjacent Unit: 1/32" maximum. Maximum variation is mandatory on walls where only one surface is exposed. Where two surfaces are exposed to view, the more prominent face, per Architect, is to have maximum variation maintained, with the less prominent face allowed to exceed the maximum tolerance.
3. Maximum Variation from Level or Grades for Exposed Lintels, Sill, Parapets, or Horizontal Grooves:
a. ¼" in any bay or 20'-0" maximum.
b. ½" in 40'-0".
4. Maximum Variation from Plan Location or Linear Building Line or Related Portions of Columns, Walls, and Partitions:
a. ½" in any bay or 20'-0" maximum.
b. ¾" in 40'-0".
5. Maximum Variation in Cross-sectional Dimension of Columns and Thickness of Walls: ±¼".
6. Maximum Variation in Mortar Joint Thickness:
a. Bed Joint: ±⅛".
b. Head Joint: ±⅛".

B. Dimensions are based on modular units except for special details. If units other than modular size are used, there shall be no change in story heights or other main dimensions of partition centerlines, and connecting work shall be adjusted to any changes in unit sizes.

C. Laying Concrete Masonry Units: Spread mortar beds smooth and full to cover all bearing areas. Do not furrow. Butter head joints and shove units into place. Head joints shall be staggered except where stack bond is specifically indicated. Make back joints full against the backing materials as each course is laid.
   1. Leave pipe spaces open on one full side until pipe work has been completed and inspected.
   2. Lay concrete masonry walls and partitions level, plumb, straight, and true to line within tolerances specified above.
   3. Fill the cells of exposed concrete masonry units with mortar for a width of 8" at the jambs of all openings in exterior walls.
   4. Exposed ends of units at external corners shall be solid.
   5. Units shown to be laid in stack bond shall be laid with such accuracy that a plumb line centered on a vertical joint in an upper course will be entirely within the width of the corresponding vertical joint in every lower course.
   6. Unless shown otherwise, provide vertical control joints not to exceed a length to height ratio of 1-1/2 : 1 or 25 ft., whichever is less.
   7. Maximum pour of grout in vertical cells shall be limited to 5'-0" unless cleanouts are provided at each cell.
   8. At veneer construction, install bond breaker between first course of masonry veneer and concrete foundations and beams. Gaskets at bottom of cavity walls shall not be used as bond breakers unless gasket occurs under the first course of masonry.

D. Reinforcing Masonry Joints: Reinforce the bed joints of concrete masonry unit walls and partitions with continuous joint reinforcement strips.
   1. Furnish strips in long lengths. Width of strips shall be 2" less than nominal overall width of the wall or partition.
   2. Lap strip ends 12" and bed side rods in mortar for complete cover and bond.
   3. Install strips in bed joints spaced 16" o.c. for exterior walls and 24" o.c. for interior partitions. Reinforcement shall extend into and bond the facing wythe in walls.

E. Bonding: Tie together all masonry unit construction within walls and at intersections of walls by masonry bond and staggered vertical joints. Toothing will not be permitted except where specifically authorized by the Architect. Where walls must be built in advance of adjacent walls, form the stop-off by racking back.
   1. Where bond with joint reinforcement cannot be made, use wall ties spaced not more than 16" o.c. horizontally and vertically. Ties shall be laid in the joints, not shoved into wet mortar after setting the next course of masonry.
   2. Partitions between rooms without suspended ceilings, and 4" thick partitions with an unsupported length of more than 12 ft. shall be extended to the floor or roof above and wedged and sealed against it. Extend all other partitions above the highest adjacent ceiling, unless indicated to extend up to floor or roof above.

F. Joints shall be 3/8" wide. Joints shall be straight and uniform.
   1. Tool and work exposed joints to a hard, dense surface with a sled runner and leave without any shrinkage cracks. Delay tooling until the mortar has set thumbprint hard. Tool the joints in masonry walls behind chalkboards and tackboards.
   2. Rake out the joints to be caulked and keep them free of mortar as the work progresses.
   3. Provide control joints at inside corners with backer rod and sealant.

G. Masonry Bearings: Provide bearings of common brick under framing members which bear on masonry walls unless the members bear directly on concrete-filled bond beams.

H. Chases: Form chases and recesses to the required dimensions and lines, strike joints flush and remove excess mortar. Before closing chases and similar inaccessible spaces with masonry, remove all rubbish and sweep out the area.

I. Lintels and Beams: Provide lintels and beams for openings in masonry walls. This includes lintels at masonry openings for ducts. Verify duct layouts on the mechanical drawings.
   1. Reinforced Masonry Lintels: Construct and reinforce masonry lintels where shown.
      a. Make concrete masonry lintel units of the same material and by the same process as the other concrete masonry units used in the building.
      b. Use trough-type units, not regular units with the web knocked out. Fill the troughs with concrete.
      c. Build lintels in place where possible and cure at least 14 days before subjecting them to load. Provide at least 8" bearing at each jamb.
      d. Where reinforcing is not specifically called out for masonry lintels, use not less than a #4 bar top and bottom of 8" high masonry units for each 4" thickness of wall.
   2. Bond Beams: Provide bond beams in masonry walls. Bond beams shall be continuous where possible.

J. Flashing:
1. Build in flashings which enter the masonry, using the materials and following the instructions of the pertinent sections of the specifications.
2. Create end dams at ends of window heads, at edges of storefronts, and other vertical elements to channel water to nearest weep hole away from window mullions and other items which might allow water to travel vertically.

K. Weeps: Install weep holes in veneer at 32" o.c. horizontally for clay masonry and 32" o.c. for 16" long concrete masonry, above through-wall flashing, above shelf angles, and at top and bottom of walls. Install cellular plastic weeps in strict accordance with manufacturer's written instructions and recommendations.

L. Cavity Drainage Material: Install cavity drainage material in cavities to comply with manufacturer's written instructions and recommendations. Provide one or more thickness as required to fill cavity width. Install cavity drainage material with fabric facing to the exterior of the wall.

M. Built-in work:
1. As work progresses, build-in metal door frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the work supplied by other sections.
2. Build-in items plumb and level.
3. Bed anchors of metal door and glazed frames in mortar joints. Fill frame voids solid with mortar. Fill masonry cores with mortar minimum 8" from framed openings.
4. Do not build-in organic materials subject to deterioration.

N. Cutting and fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other sections of work to provide correct size, shape, and location.
2. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

O. Miscellaneous Work:
1. Cooperate with other trades in installing their work in masonry. Furnish bedding mortar and set loose lintels. Cooperate in setting bucks and frames, maintain them in position and build them in with anchors properly placed. Do not distort frames by crowding.
2. Cut and form openings for recessed items and for electrical and plumbing installations so that wall plates and escutcheons will completely cover the openings. Cut edges shall be clean, sharp and straight.
3. Fill solid with mortar the spaces around and behind metal door frames.
4. Point with mortar the openings around flush-mounted electrical outlet boxes.

P. Curing: In dry weather, masonry exposed to wind and sun shall be wet with a fine water spray several times each day for at least 6 days, starting as soon as the mortar has set sufficiently to resist erosion.

Q. Non-Load-Bearing Concrete Masonry Unit Partitions: Partitions which extend up to structure above for fire, acoustical, or security reasons, shall terminate within 2" of structural deck, joists or beams to allow for deflection. Fill 2" gap with sealant and fire safing to achieve proper rating.

3.3 PROTECTION

A. Protect finished installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

B. Maintain protective boards at exposed external corners which may be damaged by construction activities.

C. Provide protection without damaging completed work.

D. At the end of each day's work, cover the tops of masonry walls, window sills and jambs, door jambs, and any other unfinished exposed cavity wall opening with plastic sheeting or other suitable material. Cover shall extend a minimum of 2' down both sides of walls and shall be held securely in place with Hohmann & Barnard, Inc. Masonry Wall Clamp No. HB3000.

E. Keep expansion joint voids clear of mortar.

3.4 POINT AND CLEAN

A. Pointing: Upon completion of the masonry work, fill and neatly point line nail holes and other defects. Remove mortar droppings from projecting surfaces.

B. Cleaning: Clean exposed concrete masonry units by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

3.5 FIELD QUALITY CONTROL

General: Owner will employ services of an independent materials testing laboratory to perform specified inspections and testing.

A. Coordinate with Owner’s testing laboratory to provide PERIODIC inspection of the following tasks:
   1. As masonry construction begins, and every 5000 sq. ft. during construction, the following shall be verified to ensure compliance:
      a. Proportions of site prepared mortar.
      b. Construction of mortar joints.
      c. Location of reinforcement and connectors.
   2. During construction, the inspection program shall verify:
      a. Size and location of structural elements.
      b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
      c. Specified size, grade, and type of reinforcement and anchor bolts.
      d. Protection of masonry during cold weather (temperature below 40°F.) or hot weather (temperature above 90°F.).
   3. Prior to grouting at interior non-load-bearing partitions shown in the Architectural drawings, the following shall be periodically verified to ensure compliance:
      a. Grout space is clean.
      b. Placement of reinforcement and connectors.
      c. Proportions of site-prepared grout.
      d. Construction of mortar joints.

B. Coordinate with Owner’s testing laboratory to provide CONTINUOUS inspection of the following tasks:
   1. Prior to grouting at masonry walls shown on the Structural Drawings, the following shall be continuously verified to ensure compliance:
      a. Grout space is clean.
      b. Placement of reinforcement and connectors.
      c. Proportions of site-prepared grout.
      d. Construction of mortar joints.
      e. Grout placement shall be verified to ensure compliance with code and construction document provisions.

END OF SECTION

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SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Structural steel.
2. Prefabricated building columns.

B. Related Sections:
1. Section 01 45 23 "Testing and Inspection Services".
2. Section 05 12 13 "Architecturally Exposed Structural Steel Framing".
3. Section 05 31 00 "Steel Decking".
4. Section 05 50 00 "Metal Fabrications".
5. Section 05 51 00 "Metal Stairs."
6. Section 09 96 00 "High-Performance Coatings".
7. Section 13 34 19 "Metal Building Systems".

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A 6 with flanges thicker than 1 1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 REFERENCES

A. Comply with applicable provisions of the following specifications and documents: The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AISC "Code of Standard Practice for Steel Buildings and Bridges”.

2. AISC "Specification for Structural Steel Buildings," including the "Commentary" and the Supplements thereto, as issued.
3. AISC "Specification for Architecturally Exposed Structural Steel".
4. AISC's "Seismic Provisions for Structural Steel Buildings".
5. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
6. AWS D1.1 Structural Welding Code.
7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
9. SSPC (Steel Structures Painting Council), Painting Manuals, Volumes 1 and 2.
10. UL Fire Resistance Directory.

B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.5 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
1. Select and complete connections using schematic details indicated and AISC 360.

B. Moment Connections: Type FR, fully restrained.

C. Construction: System as indicated on Drawings.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include a statement indicating cost for each product having recycled content.
2. Laboratory Test Reports for Credit IEQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.
8. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. At full penetration welds, Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
   1. Qualification Data: For qualified installer, fabricator, and testing agency.
   2. Welding certificates.
   3. Mill test reports for structural steel, including chemical and physical properties.
   4. Product Test Reports: For the following:
      a. Bolts, nuts, and washers including mechanical properties and chemical analysis.
      b. Direct-tension indicators.
      c. Tension-control, high-strength bolt-nut-washer assemblies.
      d. Shear stud connectors.
      e. Shop primers.
   5. Source quality-control reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, or P3 as applicable for exposure or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:
   1. AISC 303.
   2. AISC 341 and AISC 341s1.
   3. AISC 360.
   4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.10 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
1. W-Shapes: 60 percent.
2. Channels, Angles, M, S-Shapes: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

B. W-Shapes: Refer Structural General Notes.

C. Channels, Angles, M, S-Shapes: Refer Structural General Notes.

D. Plate and Bar: Refer Structural General Notes.

E. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, Grade 50.

F. Cold-Formed Hollow Structural Sections: Refer Structural General Notes.

G. Steel Pipe: Refer Structural General Notes.
1. Weight Class: See Plans.
2. Finish: Black except where indicated to be galvanized.

H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts.
1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers (All bolts located in Crawl Space): ASTM A 325, Type 1, heavy-hex steel structural bolts.
1. Finish: Hot-dip or mechanically deposited zinc coating.

2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Plain or Mechanically deposited zinc coating, where required.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, See Anchor Bolt Schedule on Drawings for Grade.
1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish:
a. General Condition – Plain
b. Crawl Space - Hot-dip zinc coating, ASTM A 153, Class C.

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

I. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
a. Amscot Structural Products Corp.
b. Fluorocarbon Company Limited.
c. R.J. Watson Bridge & Structural Engineered Systems.
d. Seismic Energy Products, L.P.
2. Mating Surfaces: PTFE and PTFE or mirror-finished stainless steel.
3. Coefficient of Friction: Not more than 0.05.
4. Design Load: Not less than 5,000 psi .
5. Total Movement Capability: 2 inches.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer (General): Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Primer (Crawl Space Steel): Tnemec Perimeprime Series 394.

D. Galvanizing Repair Paint: SSPC-Paint 20.

2.4 GROUT

A. Refer Section 03 30 00.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in final approved Shop Drawings.
1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other effects.
3. Camber structural steel members where indicated. The camber specified is the camber that is measured in the field with the beam on its side so that the beam weight has no effect. During shipment and handling, cambered members shall be supported in a way that will not result in loss of camber.
4. Camber tolerance
   a. Beams 50 feet and less; plus or minus 1/2 inch.
   b. Beams greater than 50 feet; plus or minus 1/2 inch, except tolerance can be increased 1/8 inch for each 10 feet or fraction thereof in excess of 50 feet.
   c. Contact engineer for members outside specified camber tolerance. Provide engineer with a list of beam locations and actual measured camber amounts. Submit an engineered shoring plan, if requested, that will allow the beam to deflect to the horizontal position after concrete placement without overloading the framing below.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.
1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes by burning.

I. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Base plates hole sizes for anchor bolts may be oversized to facilitate erection:
1. Bolts 3/4 inch to 7/8 inch diameter: 1/2 inch oversize.
2. Bolts 1 inch to 1 1/2 inch diameter: 3/4 inch oversize.

3. Bolts over 1 3/4 inch diameter: 1 inch oversize.

J. Base Plate Washers: Sizes shall be as follows:
1. 3/4 inch diameter Bolts: 2 inch diameter x 1/4 inch thick
2. 7/8 inch diameter Bolts: 2 1/2 inch diameter x 5/16 inch thick
3. 1 inch diameter Bolts: 3 inch diameter x 3/8 inch thick
4. 1 1/4 inch diameter Bolts: 3 inch diameter x 1/2 inch thick
5. 1 1/2 inch diameter Bolts: 3 1/2 inch diameter x 1/2 inch thick
6. 1 3/4 inch diameter Bolts: 4 inch diameter x 5/8 inch thick
7. 2 inch diameter Bolts: 5 inch diameter x 3/4 inch thick

K. Architecturally Exposed Structural Steel (AESS): Fabricate with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Specification for Architecturally Exposed Structural Steel" for architecturally exposed structural steel.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, Pretensioned, or Slip critical as required or indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8, where required, for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

SHOP PRIMING

A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing) excluding crawl space steel. Crawl space steel shall be primed regardless of whether it is to receive fireproofing.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

D. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

E. Crawl space steel to be primed to a DFT between 2.5 and 3.5 mils.

F. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

G. GALVANIZING

H. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural steel frame and located in exterior walls.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Refer Section 01 45 23.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations, to elevations indicated, and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, Pretensioned, or Slip critical as indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00

SECTION 05 21 00

STEEL OPEN WEB JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH- and DLH-series long-span steel joists.
5. CJ-series composite steel joists.
6. Joist girders.
7. Joist accessories.
   a. Extended ends.
   b. Ceiling extensions.
   c. Bearing plates.
   d. Bridging.
   e. Side wall anchors.

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete".
2. Section 01 45 23 “Testing and Inspection Services”
3. Section 04 20 00 "Unit Masonry".
4. Section 05 12 00 "Structural Steel Framing".
5. Section 05 31 13 “Steel Floor Decking”.
6. Section 05 31 23 “Steel Roof Decking”.

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 Structural Welding Code
2. SJI “Standard Specification Load Tables and Weight Tables for Steel Joists and Joist Girders”.
3. SDI “Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution”.
4. SSPC Steel Structures Painting Council Painting Manual.
5. UL Fire Resistance Directory.
6. ICBO Product Evaluation Reports.
7. FM Roof Assembly Classifications.

B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Laboratory Test Reports for Credit EQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:
1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.
4. Shop drawings containing special joists shall be submitted with a design load summary for each special joist design. Load summary will be reviewed and returned with the joist submittal. Shop drawings containing special joists submitted without the specified load summary will be returned unchecked as an incomplete submittal. Shop drawings containing special joists shall be signed and sealed by the qualified professional engineer responsible for the design of the joists.

1.6 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Qualification Data: For manufacturer.
2. Welding certificates.
3. Manufacturer certificates.
4. Mill Certificates: For each type of bolt.
5. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.9 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and or masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
   1. Use ASD; data are given at service-load level.
   2. Design special joists to withstand design loads with live-load deflections no greater than the following:
      a. Floor Joists: Vertical deflection of 1/360 of the span.
      b. Roof Joists: Vertical deflection of 1/360 of the span.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2.2 MATERIALS

A. Steel: Comply with SJI’s “Specifications” for chord and web members.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
   1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions and Extended Ends: Provide top chord extension or extended ends where shown on plans. Design for load indicated on plans.

E. Camber joists according to SJI's Specifications unless noted otherwise.

F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on plan.
   1. Joist Type: Refer to Drawings.

2. End Arrangement: Refer to Drawings.
3. Top-Chord Arrangement: Refer to Drawings.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Camber long-span steel joists according to SJI's Specifications unless noted otherwise.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated on plan.
1. End Arrangement: Refer to Drawings.
2. Top-Chord Arrangement: Refer to Drawings.

B. Provide holes in chord members for connecting and securing other construction to joist girders.

C. Camber joist girders according to SJI's Specifications unless noted otherwise.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 PRIMERS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.7 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint for interior exposure or Hot-dip zinc coat according to ASTM A 123/A 123M for exterior or weather exposure.

C. Furnish ceiling extensions (where indicated), either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

D. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
1. Finish: Plain, uncoated.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.

G. Galvanizing Repair Paint: ASTM A 780.

H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.8 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 2 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications", "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework as indicated on Drawings. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance, and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using high-strength structural bolts as indicated on Drawings. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

3.4 REPAIR AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 23

STEEL ROOF DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Roof deck.
2. Acoustical roof deck.
3. Noncomposite vented roof deck.

B. Related Requirements:
1. Section 01 45 23 “Testing and Inspection Services”
2. Section 05 12 00 "Structural Steel Framing".
3. Section 05 50 00 "Metal Fabrications".

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standard referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 – Structural Welding Code
2. AWS D1.3 – Structural Welding Code – Sheet Steel
3. SDI – Design Manual
4. SSPC – Painting Manual
5. UL – Fire Resistance Directory
6. ICBO – Product Evaluation Reports
7. FM – Roof Assembly Classifications

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.
B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Laboratory Test Reports for Credit EQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE
A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
4. Deck Profile: As indicated on plan.
5. Profile Depth: As indicated on plan.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
7. Span Condition: Triple span or more.
8. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
3. Deck Profile: As indicated in Structural General Notes.
4. Cellular Deck Profile: As indicated in Structural General Notes.
5. Profile Depth: As indicated in Structural General Notes.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated in Structural General Notes.
8. Span Condition: Triple span or more.
9. Side Laps: Overlapped or interlocking seam at Contractor's option.
10. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
11. Sound-Absorbing Insulation: Manufacturer's standard pre-molded roll or strip of glass or mineral fiber.
    a. Factory install sound-absorbing insulation into cells of cellular deck.

2.4 NONCOMPOSITE VENTED ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.; Vulcraft Group.
8. Roof Deck, Inc.
9. Verco Manufacturing Co.
10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Vented Roof Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
2. Profile Depth: As indicated in Structural General Notes.
3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Vent Slot Area: Manufacturer's standard vent slots providing 1-1/2.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth unless otherwise indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A 780.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
   1. Fasteners shall provide diaphragm shear and uplift resistance equal to or greater than welding indicated herein and on Drawings.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: As indicated on Structural Plans.
   2. Weld Spacing: As indicated on Structural Plans.
   3. Weld Washers: Install weld washers at each weld location if deck gauge is lighter than 22 gauge.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals shown on Structural Plans:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Lightgage structural metal studs in exterior wall systems used as masonry veneer back-up. used as metal panel back-up

B. Related Sections:
1. Section 05 12 00 - Structural Steel Framing.
2. Section 05 50 00 - Metal Fabrications: steel angles.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System.
4. Section 09 21 16 - Gypsum Board Assemblies: non-loadbearing partition studs.

1.2 SYSTEM DESCRIPTION

A. Masonry Veneer: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/600 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/600, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/600.

B. All Other Veneer/Cladding: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/240 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/240, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/240.

1.3 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's specifications, load tables, dimension diagrams, anchor details, installation instructions for products to be used in lightgage framing work, and type and location of fasteners. Describe materials and finish, product criteria, and limitations.

B. Structural Calculations: Submit structural calculations prepared by manufacturer for review by project engineer.
1. Description of design criteria.
2. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
3. Selection of framing components and accessories.
4. Verification of attachments to structure and adjacent framing components.
5. Sealed by a professional engineer registered in the state where the project is located.
6. Engineer shall have a minimum of 5-years’ experience with projects of similar scope.

C. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Drawings shall incorporate fabrication and erection details.

D. Evaluation Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. All structural members shall be designed in accordance with AISI "Specifications for the Design of Cold-Formed Steel Structural Members", latest edition.

B. Qualifications: Welders and welding procedures shall comply with the requirements of ANSI/AWS D1.3 Structural Welding Code.

1.5 DELIVERY AND STORAGE

A. Protect metal members from rusting and damage. Deliver to project site in manufacturer's containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry, ventilated space.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lightgage Steel Framing: Basis of Design ClarkDietrich Building Systems (phone 800.543.7140 web site: www.clarkdietrich.com). ASTM A 1003, Provide Metal Framing, 18 gage minimum with 1-5/8" flange minimum, structural stud framing members. Refer to structural drawings for specific size, type, and locations of framing which may be used on the project.

B. Substitutions: Under provisions of SECTION 01 62 00 - PRODUCT OPTIONS. Other acceptable manufacturer's with products of equal substance and function include:
CEMCO Steel
Marino\Ware
The Steel Network

C. Furnish bridging and bracing members shown or required for a complete and structurally sound installation.

D. Track: Formed steel; channel shaped; same width and finish as studs, tight fit; 18 gage thick, solid web.

2.2 ACCESSORIES

A. Slide Clips: ASTM A 653, Grade A, galvanized metal clip.
1. ASTM A 653, Grade C, galvanized metal clip.
2. Designed and manufactured for attachment of metal stud framing to edge of structural steel framing.
3. Permits differential vertical movement between stud and floor or roof structure.
4. Clip and its connection to structure shall be adequate to safely brace metal studs to resist design lateral load of at least 330 pounds (allowable stress increase permitted by Building Code already taken into account).

B. Bracing and Furring: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Bridging: 1-1/2" C.R. channels, 16 ga; same finish as framing members.

D. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

E. Galvanizing Repair Paint: Organic Zinc-Rich coating containing 95% metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD P-21035A for repair of hot-dip galvanizing; as manufactured by ZRC Worldwide (phone 800.831.3275 web site: www.zrcworldwide.com). Provide Z.R.C. Cold Galvanizing Compound.

F. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.3 FASTENERS

A. Self-drilling, Self-tapping Screws, Bolts, Nuts and Washers: ASTM A 90, hot dip galvanized.

B. Anchorage Devices: Power driven as recommended by manufacturer for size and spacing.

C. Welding Electrodes: Comply with AWS standards D1.1 and D1.3.

D. Post-Installed Anchors (for securing window perimeter angle to masonry or concrete structure): Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate; zinc coated by hot-dip process according to ASTM A 153, Class C.

2.4 FABRICATION

A. General: Framing components may be prefabricated into panels prior to erection. Cut framing components accurately to fit squarely against abutting members. Hold members firmly in position until properly fastened. Prefabricated panels shall be square and braced against racking. Attach similar components by welding.

B. Protective Finishing: Paint abraded surfaces and welds after fabrication, using galvanizing repair paint for galvanized surfaces.

2.5 FINISHES

A. All framing members shall be formed from hot-dip galvanized steel, G60 (Z180) coating, conforming to the requirements of ASTM A 1003, Structural Grade, Type H.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel framing members and accessories in accordance with the manufacturer's instructions and the erection drawings. Spacing of studs shall not exceed 16" o.c.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

C. Securely anchor track to floor and overhead structure or member. Seat studs squarely in the track with the stud flange securely attached to the flanges of both upper and lower track.
1. Attach structural components by welding, bolting or with self-drilling screws.
2. Wire tying of framing components in structural applications will not be permitted.

D. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thinness of 2.0 mils. For galvanized surfaces, apply galvanizing repair paint.

E. Construct corners using minimum three studs. Double stud at wall opening, door, and window jambs.

F. Provide vertical stud within 12 inches of jamb for brick anchor attachment at openings. Reference BIA Technical Note 28B.

G. Provide rows of horizontal bridging welded in place at spacing recommended by stud manufacturer to resist lateral forces and stud rotation.

3.2 TOLERANCES

A. Maximum Variation from True Position: ±1/8" from plan location.

B. Maximum Variation of any Member from Plane: 1/8" in 10 feet.

END OF SECTION

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous metal work and related items.

B. Related Sections:
1. Section 05 12 00 - Structural Steel Framing.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include details of each metal fabrication, including setting drawings for anchor bolts and other required anchors.

B. Submit structural calculations prepared by manufacturer for review by project engineer. Shop drawings and calculations shall be sealed by a professional engineer registered in the State of Texas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: ASTM A 36, shapes, plates and bars.

B. Threaded Fasteners: ASTM A 307, Grade A, bolts and nuts.

C. Stud Anchors: Provide headed stud anchors with a smooth shank of carbon steel with a minimum tensile strength of 60,000 psi, as manufactured by Nelson Stud Welding Div. or KSM Welding Systems Div.

D. Expansion Bolts: Fed. Spec. FF-S-325, Group II, Type A, Class 1. Provide Hilti Kwik-bolt or Ramset Trubolt stud anchors.

E. Galvanizing Repair Paint: Organic Zinc-Rich coating containing 95% metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD P-21035A for repair of hot-dip galvanizing; as manufactured by ZRC Worldwide, Marshfield, MA (phone 800.831.3275 web site: (www.zrcworldwide.com). Provide Z.R.C. Cold Galvanizing Compound.

2.2 FABRICATION

A. Fabricate and assemble metal work in the shop to the greatest extent possible.
1. Metal surfaces shall be clean and free of mill scale and rust pitting, well-formed to shape and size with sharp lines and angles. Shearing and punching shall leave clean true lines and surfaces. Exposed ends and edges shall be milled smooth with corners slightly rounded.
2. Weld shop connections to the extent practical; finish exposed welds smooth. Weld joints shall be flush.
3. Cut, drill or punch holes; do not make or enlarge by burning. Provide holes where required for connecting the work of other trades.
4. Conceal fastenings where practical. Thickness of metal and method of assembly and support shall give ample strength and rigidity.
5. Assemble parts so that joints are tight, members are in good alignment, and the finished work reproduces the drawing details as intended.
6. Stud Anchors: Weld stud anchors to miscellaneous shapes using welding equipment and procedures recommended by the manufacturer of the stud anchors used.

B. Shop Painting:
1. Carbon steel surfaces shall be cleaned, degreased, and shop coated with a straight alkyd, zinc chromate, rust inhibitive paint applied by brush or spray. Steel to be encased in concrete need not be painted.

2. Aluminum surfaces to be in direct contact with concrete and masonry shall be shop coated with zinc chromate primer.

C. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows:
1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip ⅛" thick and heavier, and for galvanizing assembled steel products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver, store and erect metal work in such manner that the parts are not damaged or deformed. Install the work true to line, plumb, level, in proper alignment with other work, and free of sags, buckles and other objectionable defects. Anchorage shall be adequate to safely resist all stresses to which the work will normally be subjected.

B. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils. For galvanized surfaces, apply galvanizing repair paint.

3.2 MISCELLANEOUS METAL SCHEDULE

A. General: The following is a general list of the metal work to be furnished under this section of the specifications. Other items of miscellaneous metal work shown and noted on the drawings and not mentioned elsewhere in the specifications shall be furnished as though specifically described herein.

B. Loose Lintels: Lintels of steel shapes and plates where required at exterior brick veneer and as detailed.
1. End bearing shall be at least 8".
2. Where steel lintels are not specifically called out, furnish at least one steel angle for each 4" thickness of masonry in the wall.
3. Wrap bearing ends of lintels with flashing to achieve a bond breaker between the lintel and the masonry.
4. Galvanize steel lintels located in exterior walls.

C. Roof Curbs: Fabricate curbs of steel angles, channels and plates at roof openings for ducts, exhaust fans and other set-on items.
1. Miter and weld corners.
2. Bolt or weld curbs to roof framing members.

D. Storefront Bracing: Provide braces of steel angles, channels and plates to reinforce and stiffen the head of the aluminum storefront framing.

E. Track Supports: Provide framing and brackets of steel shapes as detailed to support curtain track, accordion folding partition, folding panel partition, or overhead barrier-free lift track.
1. Erect to be level, straight and rigid.
2. Punch for mounting bolts as required.

F. Ladders: Fabricate ladders of steel bars and shapes.
1. Weld all connections.
2. Bolt ladders to floor and wall with steel brackets and clips.
3. Ladder Rungs: Provide SlipNOT®, grit-free, mill finish steel Grade #2 – Medium rungs as manufactured by the W.S. Molnar Company (1-800-SlipNOT) or approved equivalent. Reference drawings for dimensions. Steel shall incorporate an anti-slip primarily martensitic steel surface covering 100% of the substrate consisting of a random hatch matrix with a surface hardness between 55 – 63 on the Rockwell “C” scale and a surface to substrate bond strength of at least 4,000 psi. The non-slip surface shall have a minimum coefficient of friction of 0.8 and be listed as slip resistant by Underwriters Laboratories.
4. Galvanize exterior ladders after fabrication. Reference Manufacturer’s galvanizing guidelines, as to not damage the anti-slip surface.

G. Toilet Partition Supports: Provide framing, headers and brackets of steel shapes to support the ceiling hung portion of the toilet partitions.
   1. Erect the support headers at the correct height to be level, accurately aligned and rigid.
   2. Punch for mounting bolts as required.

H. Miscellaneous Steel Shapes: Channels, wide flange shapes, angles, plates, tubing, connections, and bolts where shown and detailed on Drawings. Hot-dip galvanize where exposed to weather or touching exterior masonry after fabrication. Set mechanical unit frames directly on joists, not on deck. Provide an angle frame supported by structure around all roof penetrations including hatches and ductwork.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Framing with dimension lumber, wood blocking and nailers, wood furring and grounds, plywood sheathing, subflooring and plywood backing panels.

B. Related Sections:
   1. Section 06 40 00 - Architectural Woodwork.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data:
   1. Include all data for rough carpentry products required for installation.
   2. Fire-retardant-treated wood product data, including certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

C. Warranty: Provide warranty of chemical treatment manufacturer for each type of treatment.

1.3 QUALITY ASSURANCE

A. Lumber Grading: Lumber Grading Rules and Wood Species in accordance with Voluntary Product Standards. Grading rules of following associations apply to materials furnished.
   1. Southern Pine Inspection Bureau (SPIB).
   2. West Coast Lumber Inspection Bureau (WCLIBB).
   3. Western Wood Products Association (WWPA).

B. Grade Marks: Identify lumber and plywood by official grade mark.
   1. Lumber: Include symbol of grading agency, mill name, grade, species, grading rules and condition of seasoning at time of manufacturer.
   2. Plywood: Include type, span rating or group number, exposure durability classification, and agency mark of APA.

1.4 QUALIFICATIONS

A. Design structural site fabricated items under direct supervision of a professional structural engineer experienced in design of this work and licensed in the State of Texas.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store products above ground, on platforms or skids, and covered with waterproof coverings. Provide for adequate air circulation.

C. Do not store seasoned materials in damp or wet locations.

D. Support products in such a way as to prevent warping and distortion.

1.6 WARRANTY

A. Provide a 20-year warranty for each type of chemical treatment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood: Lumber for framing and general carpentry work shall be sound, well manufactured, surfaced S4S material with a moisture content limit of 19%.
   1. Dimension: SPIB grade marked No.2 Dimension Southern Pine or WCLB grade marked No. 2 Dimension Douglas Fir.
   2. Boards: SPIB grade marked No. 2 Boards Southern Pine.
   3. Redwood: RIS grade marked Construction Heart California Redwood.

B. Plywood: Plywood for general carpentry work shall be APA trademarked, 23/32" minimum thickness, Tongue & Groove.
   1. Interior: APA Rated Sturd-I-Floor, 24 oc, Exposure 1, fire-retardant treated.
   2. Exterior: APA Rated Sturd-I-Floor, 24 oc, Exterior, fire-retardant treated.

C. Rough Hardware:
   1. Anchors, bolts, screws, and spikes shall be of proper types and sizes to support the work, to draw the members into place, and to hold them securely. Bolt heads and nuts bearing on wood shall have standard washers.
   2. Metal fasteners to secure wood grounds and blocking to masonry and concrete shall be of the type best suited to the conditions and spaced no more than 16" o.c. Wood plugs and nailing blocks are not acceptable.
   3. Nails shall be of the sizes and types intended for the particular use.
   4. Rough hardware exposed to the weather or embedded in exterior masonry and concrete walls or slabs shall be hot-dipped galvanized.
   5. Nails and bolts used with preservative treated lumber shall be hot-dipped galvanized.

2.2 WOOD TREATMENT

A. Preservative Treatment:
   1. Comply with applicable requirements of AWPA U1; Category UC2 for interior construction not in contact with ground, Category UC3b for exterior construction not in contact with ground, and Category UC4a for items in contact with ground.
      a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
      b. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
   2. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19% for lumber and 15% for plywood. Do not use material that is warped or that does not comply with requirements for untreated material
   3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

B. Fire-Retardant Treatment:
   1. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   2. Wood shall be fire-retardant chemically treated and pressure impregnated; with a flame spread index of 25 or less and a smoke development of 0-450 when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   3. Treatment shall not promote corrosion of metal fasteners.
   4. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   5. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   6. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841

7. Kiln-dry lumber and plywood after treatment to maximum moisture content of 19% for lumber and 15% for plywood.
8. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying; discard damaged or defective pieces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
1. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Scribe and cope as required.
3. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards and as required to draw members into place and securely hold same unless otherwise indicated. Use washers under all bolt heads.
4. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
5. Make tight connections between members to develop full strength of members.
6. Install fasteners without splitting of wood.
7. Pre-drill as necessary.
8. Comply with APA E30 requirements for plywood.
9. Install fasteners at spacings recommended by AFPA National Design Specifications for Stress Grade Lumber and Its Fastening - 1973 for lumber and APA Guide E30 for Plywood, unless more restrictive code requirements dictate tighter spacing or heavier fasteners.
10. Locate members as indicated on the drawings. Size, spacing or spans shall not be changed without specific approval of Architect. Take care to place proper grades and species of members where indicated in accordance with the lumber schedule herein.
11. Temporary brace framing at the end of each days' work until all framing is completed and securely anchored. Leave temporary bracing in place as long as required for safety. As work progresses, securely connect work to compensate for dead load, wind and erection stresses.

B. Shoring: Construct shoring for masonry where required. Brace and maintain it until the mortar has set sufficiently to permit removal.

C. Blocking: Install 2x6 wood blocking between studs to stiffen the structure and for the support of other work. Provide 2x6 blocking for installation of wall-mounted objects.

D. Nailers: Install nailers of adequate size where detailed. Nailers shall be bolted in place. Where bolt sizes and spacing are not specifically noted, use not less than ⅜" bolts at 32" o.c., staggered. Roof Curbs: Construct wood curbs as detailed to frame openings and support flashings in roof decks. Bucks: Install wood bucks for frames as required. Members shall be at least 2 x 4 material. Spike securely together. In masonry, provide 16 ga. corrugated metal jamb anchors screwed to the back and spaced to work masonry bed joints, not more than 32" apart.

E. Step Framing: Construct wood step framing to detail to support finish treads and risers.

F. Bridging: Install cross-bridging between wood joists where the span exceeds 8 ft. Use 1 x 4 material and bevel cut the ends to fit. Drive tight and double nail each end.

G. Floor Underlayment for Platforms/Masonite Flooring: Install underlayment with face grain perpendicular to supports and spanning minimum two spans. Locate ends and sides over supports and stagger the short joints. Leave 1/8" spacing between all panel ends and edges. Use screw-type nails on 6" centers at ends and 12" centers at intermediate supports. Set screw heads 1/16". Start nails 3/8" from panel edges. Nail and glue using adhesives meeting APA specification AFG-01 or ASTM D 3498, with installation per APA’s Form E30.

H. Plywood Backing Panels: Screw attach through gypsum board to supports.

3.2 PROTECTION

A. Protect products from moisture absorption and subsequent warping or deterioration until subsequent construction can proceed.

END OF SECTION

SECTION 06 16 56

AIR- AND WATER-RESISTIVE SHEATHING BOARD SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vapor-permeable, air- and water-resistive wall sheathing.
2. Site-fluid-applied, vapor-permeable air barrier flashing.
3. Accessories.

B. Related Sections:
1. Section 01 45 00 - Quality Control: for general mockup requirements.
2. Section 01 45 23 - Testing and Inspection Services: for coordination with testing agency.
3. Section 05 40 00 - Cold-Formed Metal Framing: for structural framing support of panels.
4. Section 06 10 00 - Rough Carpentry: wood blocking and nailers.
5. Section 07 11 13 - Bituminous Dampproofing; behind below-grade masonry veneer and at non-conditioned buildings.
6. Section 07 27 26 - Fluid-Applied Membrane Air Barriers: air barrier on masonry backup.
7. Section 07 65 00 - Flexible Flashing: for flexible flashing components integrating with transition materials specified in this Section.
8. Section 07 92 00 - Joint Sealants: for backing materials.
9. Division 07 roofing Sections for roof assembly air barriers and interface coordination.
10. Section 09 21 16 - Gypsum Board Assemblies: for wall sheathing requirements for portions of the Work not requiring board product air barriers specified in this Section.

1.2 DEFINITIONS

A. Air barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air barrier Assembly: The collection of ABs and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air barrier Material (AB): Air tight barrier made of material that is relatively air impermeable but moisture vapor permeable, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

D. Material Transitions: Areas where the WRB/AB fiberglass-mat gypsum sheathing connects to beams, columns, slabs, parapets, foundation walls, roofing systems, and at the interface of dissimilar materials.

E. Rough Openings: Openings in the wall to accommodate windows and doors.

F. Water-Resistive Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, and installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate installation of board product air barriers with framing installation and subsequent operations that impact finished envelope air barrier work.
2. Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

B. Preinstallation Conference: Conduct conference at Project site.
1. Review board product air barrier accessory materials installation, including joints between sheathing boards and transitions to abutting construction including air barriers work of other Sections. Review requirements for forming and sealing penetrations of air barrier by other trades.
2. Review requirements for each type of air barrier product and installation, project and manufacturer's details, mockups, testing and inspection requirements, and coordination and sequencing of air barrier work with work of other Sections.

3. Review manufacturer's written instructions for meeting Project requirements for substrates specified, including three-dimensional video model demonstrating proper application of components at wall openings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of air barrier product assembly and accessory. Indicate assembly component materials and dimensions and include construction and application details.
   1. Include data for framing preparation instructions and recommendations.
   2. Include data for substrate preparation instructions and recommendations.
   3. Include data for air- and water-resistive sheathing board assembly product data.
   4. Include standard drawings illustrating manufacturer's written installation and finishing instructions applicable to Project, including details for joints, counterflashings, penetrations, terminations, and tie-ins to adjacent construction.

B. Shop Drawings: For locations and extent of WRB/AB system.
   1. Include details of typical conditions, special joint conditions, and intersections with other building envelope systems and materials.
   2. Include counter flashings and details showing bridging of envelope at substrate changes.
   3. Detail sealing penetrations, and flashing around windows and doors.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, testing agency, and manufacturer.

B. Manufacturer Product Certificates: Indicate compliance with requirements of specified products under Performance Requirements or indicated on Drawings.

C. Fire-Propagation Characteristics Certificate: From a qualified testing agency, documentation that air barrier system as a component of a wall assembly has been tested or engineered to pass NFPA 285. Include system classification number of testing agency on Shop Drawings.

D. Product Certificates: Indicate compliance with requirements of specified products in "Performance Requirements" Article or as indicated on Drawings.

E. Product Test Reports: For each air barrier product, and air- and water-resistive sheathing board assembly, for tests performed by a qualified testing agency.

F. Sample Warranties: For manufacturer’s warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified air barrier manufacturer experienced in manufacture of air barrier as one of its principal products.

B. Installer Qualifications: An experienced entity that employs applicators trained in application of specified products.

C. Testing Agency Qualifications: Qualified independent agency experienced in installing specified waterproofing system, and qualified to perform observation and inspection specified in "Field Quality Control" Article to determine Installer's compliance with the requirements of this Project. Testing agency to be acceptable to Architect and retained by the Owner.

D. Mockups: Provide air barrier mockup application within mockups required in other Sections, or if not specified, in an area of not less than 64 sq. ft. of wall surface where directed by Architect for each type of backup wall construction. Include examples of surface preparation, crack and joint treatment, air barrier application, and flashing, transition and termination conditions. Build mockups to set quality standards for materials and execution.
   1. Include air barrier system tie-in details between walls and roof, and with wall and foundation wall. Include penetrations and openings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packaging and store in an enclosed shelter providing protection from damage and exposure to the elements.
   1. Store within temperature limits required by manufacturer.
   2. Store air- and water-resistive sheathing board supported on risers on a flat platform.
   3. Comply with manufacturer's written instructions requirements for safety and handling.

B. Discard liquid materials that cannot be applied within their stated shelf life.

C. Store accessory materials in a location with constant ambient temperatures of 40 to 80 deg F.

1.8 FIELD CONDITIONS

A. Cold Weather Conditions:
   1. Site Fluid-Applied, Vapor-Permeable Joint Flashing: Comply with manufacturer's cold weather application written instructions when atmospheric temperatures or substrate surface temperatures are less than 40 deg F.
   2. Accessories and Sealants: Comply with manufacturer’s cold weather application instructions when atmospheric temperatures or substrate surface temperatures are less than 40 deg F.

B. Exposure: Comply with manufacturer’s limitations on exposure of applied product.
   1. Do not apply air barrier joint flashing to sheathing surface that is frozen or has frost.

C. Protect adjacent substrates from environmental conditions that affect air barrier performance

D. Coordinate installation of membrane air barrier with completion of roofing, below grade, factory fluid-applied membrane portion to site fluid-applied membrane portion and other work requiring interface with air barrier.

E. Schedule work for inspection of air barrier applications prior to concealment.

F. Ensure ABs are cured before covering with other materials.

1.9 WARRANTY

A. Manufacturer's Warranty for Air Barrier Products: See manufacturer's published limited warranty.
   1. Warranty Period for Air- and Water-Resistive Sheathing Board Assembly: Five years from date of Substantial Completion.

B. Manufacturer's Warranty for Site Fluid-Applied Air Barrier Products: Manufacturer agrees to furnish and install AB to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as a water-resistive barrier and air barrier, as defined in the 2015 IBC and the IECC, under normal use within specified warranty period.
   1. Manufacturer will, at its option, replace nonconforming Product or refund the purchase price of quantity of product shown to be nonconforming.
   2. Access for Repair: Provide air barrier system manufacturer with unimpeded pre- and post-occupancy access to Project facility and air barrier system for purposes of testing, leak investigation, and repair, and to reinstall removed cladding materials upon completion of repair.
   3. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer warranties specified in this article exclude deterioration or failure of ABs from the following:
   1. Movement of the structure caused by structural settlement or stresses on the air barrier exceeding manufacturer's written instructions for elongation.
   2. Mechanical damage caused by outside agents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain fluid-applied flashing materials and air barrier accessories from single source from single manufacturer.

B. Low-Emitting Materials: Fluid-applied flashing and accessories shall comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 PERFORMANCE REQUIREMENTS

A. Air- and Water-Resistive Performance: Air- and water-resistive board assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier system and as a water resistive barrier flashed to direct incidental water to wall exterior, and interface with adjacent building air barrier system components.
   1. Air- and Water-Resistive Board Assemblies: Capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air-leakage exceeding specified limits.

B. Air Permeance of Sheathing: Maximum 0.04 cfm/sq. ft of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2178.

C. Air- and Water-Resistive Board Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

D. Water Penetration under Static Pressure: Test according to ASTM E 331, as follows:
   1. No evidence of water penetration through air barrier board assembly when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 2.86 lbf/sq. ft.

E. Water Vapor Permeance; Panel Assembly: Minimum 10 perms (580 ng/Pa x s x sq. m) as tested according to ASTM E 96/E 96M, Procedure B.

F. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a qualified testing agency.

G. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

H. Fire Propagation Characteristics: Provide air- and water-resistive board assembly qualified as a component of a comparable wall assembly that has been tested or engineered to pass NFPA 285.

2.3 WALL SHEATHING

A. Air- and Water-Resistive Sheathing Board: ASTM C 1177/C 1177M, glass-mat-faced gypsum sheathing board.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC and PROSOCO, Inc.; DensElement™ Barrier System or a comparable product by one of the following:
      USG Corporation and Tremco; Securock ExoAir 430 System.
   2. Board Thickness: 5/8 inch thick.
   3. Board Type: Type X.
   4. Board Size: 48 by 96 inches for vertical and horizontal installations.
   5. Air- and water-resistive Flashing Thickness: Minimum 16 mils wet film thickness.
   6. Physical and Performance Properties:
      a. Air Permeance; ASTM E 2178: Maximum 0.04 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference.
      b. Water Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Procedure B.
      c. Combustion Characteristics; ASTM E 84: Class A.
      d. Board Product Antifungal Properties; ASTM D 3273: 10; zero defacement.
      e. VOC Content - Fluid-Applied Flashing: 50 g/L or less.
      f. UV and Weathering Resistance: Maximum 12-month exposure.

2.4 AIR BARRIER ACCESSORY MATERIALS

A. General: Provide compatible air barrier accessory materials furnished or recommended by air barrier manufacturer as required by Project conditions to produce a complete air barrier assembly identical to tested assemblies meeting performance requirements.

B. Joint Backing: See SECTION 07 92 00 - JOINT SEALANTS for backing materials.

C. Primer: Liquid primer recommended by air barrier manufacturer for exposed gypsum core edges.
1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc.; PorousPrep Sealer.
2. Color: Blue.

D. Fluid-Applied Air Barrier Flashing: Site-applied for application to joints, fasteners, penetrations, openings and material transitions.
1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc.; FastFlash Fluid-applied Flashing.
2. Color: Red.

E. Flashing and Transition Strip: Preformed silicone extrusion, 24 mils thick.
1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc.; SureSpan EX.

2.5 FASTENERS

A. Screws for Fastening Board Product Air barriers to Cold-Formed Metal Framing: Steel drill screws, ASTM C 1002, in length recommended by sheathing manufacturer for sheathing thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Framing Examination: Examine framing to determine if work is ready to receive board product air barriers.
1. Verify that surface flatness tolerances and framing spacing comply with Project requirements.
2. Verify that adequate support is provided for sheathing board edges.
3. Proceed with work once conditions comply with manufacturer's written instructions.

B. Adjacent Substrate Examination: Prior to installation of accessory materials, examine adjacent substrates to receive transition treatment.
1. Verify that substrates are sound and free of contaminants, adequately cured or aged, compatible with proposed transition materials, and free of obstructions or impediments that would result in failure of transition adhesion and failure of air barrier assembly to perform according to Project requirements.
2. Verify that concrete and masonry surfaces are visibly dry, cured, and free from release agents, curing agents, and other contaminates.
a. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that masonry joints are filled with mortar and struck flush.

C. Proceed with installation once conditions comply with manufacturer's written instructions and only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat portions of work not requiring sheathing board substrate according to air barrier manufacturer's written instructions.
1. Mask adjacent finished surfaces.
2. Remove contaminants and film-forming coatings from substrates.
3. Remove projections and excess materials; fill voids with substrate patching material.
4. Prepare and treat joints and cracks in substrate according to air barrier manufacturer's written instructions.

B. Joints: Fill gaps from 1/8 to 1/4 inch with a backer rod prior to applying fluid-applied flashing. Seal gaps greater than 1/4 inch with fluid-applied flashing approved by sheathing manufacturer.

3.3 INSTALLATION OF AIR- AND WATER-RESISTIVE SHEATHING BOARDS

A. Discard each air- and water-resistive sheathing board with damage that compromises continuity or impairs performance as an air barrier, and is unable to be repaired according to manufacturer's written repair instructions.
   1. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Comply with ASTM C 1280, GA-253, and manufacturer's written instructions.
   1. Fasten sheathing boards to cold-formed metal framing with specified screws in pattern indicated.
   2. Install sheathing boards with a 1/4-inch gap where they abut masonry or similar materials that might retain and transmit moisture to them.

C. Cut sheathing boards at penetrations, edges, and other obstructions of work to allow for application of air barrier accessory materials. Fit sheathing boards closely against abutting construction.

D. Install sheathing boards with long dimension perpendicular or parallel to framing. Abut ends and edges of sheathing boards centered over face of framing members. Offset sheathing boards joints by not less than one stud spacing.
   1. Apply sheathing boards in pieces sized to provide minimum number of joints and optimum sheathing board arrangement. Arrange joints so that pieces do not span between fewer than three support members.
   2. Do not bridge building expansion joints; cut and space edges of sheathing boards to match spacing of structural support elements.

E. Space fasteners maximum 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of sheathing boards and as required in indicated fire-resistance-rated designs.
   1. Apply fasteners so heads are seated flush to board product air barrier membrane surface without breaking or punching through the surface.
      a. Treat all fasteners with specified fluid-applied flashing used for sealing joints.
      b. Misplaced fasteners shall be left in place and treated. If fasteners must be removed, patch and treat resulting hole per system manufacturer’s written instructions.
   2. Securely attach sheathing boards to substrate by fastening as indicated, complying with the following:
      a. Table 2304.9.1, "Fastening Schedule," in the IBC.
      b. ICC-ES evaluation report for fastener.
   3. Use corrosion resistant sheet metal screw fasteners. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections.

F. Coordinate wall sheathing boards installation with flashing and air barrier accessory material installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

3.4 INSTALLATION OF SITE FLUID-APPLIED AIR BARRIER FLASHING

A. General: Apply site fluid-applied AB at joints, fasteners, penetrations, openings, and material transitions to achieve a continuous air barrier according to air barrier manufacturer's written instructions. Apply site fluid-applied AB within manufacturer's recommended application temperature ranges.

B. Apply extrusion flashing material in full contact with substrate to produce a continuous seal according to air barrier manufacturers written instructions.
   1. Vapor-Permeable Air barrier: Total wet film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 16 mils wet film thickness, applied in one or more equal coats by roller, spray, trowel, or knife.

C. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

D. Do not cover air barrier until it has been inspected and approved by the Authority Having Jurisdiction for compliance with the 2015 IBC and IECC. Components and systems subject to inspections include, but are not necessarily limited to, the following:
   1. Inspections at framing and rough-in shall be made before application of exterior and interior finishes and shall verify compliance with the code as to air leakage controls.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.5 INSTALLATION OF AIR BARRIER ACCESSORY MATERIALS

A. General: Install accessory materials according to air barrier manufacturer's written instructions and AAMA 714. Install AB to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior fenestration systems, door framing, and other openings.

B. Apply primer according to manufacturer's written installation instructions.

C. Seal punctures, voids, and seams. Patch with fluid-applied flashing extending 6 inches beyond repaired areas.

D. Seal wall penetrations according to manufacturer's written installation instructions and recommendations.

E. Connect and seal exterior wall air barrier continuously to subsequently-installed roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

F. Rough Openings: Apply bead of fluid-applied flashing to inside corners first, followed by application to jambs, header, sill, and adjacent sheathing.

G. Flashings: Seal top of through-wall flashings to air barrier with fluid-applied flashing.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
   1. Inspections: ABs, accessories, and installation are subject to inspection for compliance with requirements and photograph documentation of conditions to be concealed by subsequent Work.

B. Tests: As determined by Owner's testing agency from among the following tests:
   1. Qualitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization or ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
   2. Quantitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 783.

C. Air- and water-resistive sheathing board will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTING

A. Clean spills, stains, and overspray resulting application using cleaning agents recommended by manufacturers of affected construction. Remove masking materials.

B. Protect air barrier from damage from subsequent work. Protect materials from exposure to UV light for period in excess of that acceptable to air barrier manufacturer; replace overexposed materials and retest.

END OF SECTION

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SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concealed mastic dampproofing in masonry walls. Refer to schedule at end of section.

B. Related Requirements:
1. Section 04 20 00 - Masonry Units.
2. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
3. Section 07 13 26 - Self-adhering Sheet Waterproofing.
4. Section 07 14 00 - Fluid-applied Waterproofing.
5. Section 07 17 00 - Bentonite Waterproofing.
6. Section 07 27 26 - Fluid-Applied Membrane Air Barriers
7. Section 07 65 00 - Flexible Flashing

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Indicate properties of products, performance characteristics, proposed use, and certifications that product meets or exceeds standards.

C. Manufacturer's Instructions: Including application instructions, precautions, material safety, and methods of attachment/embedment into substrate data sheets.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Waterproofing Manual, and manufacturer's instructions, whichever are more stringent.

B. For interior and concealed in all applications, provide product certified by manufacturer to be substantially odor-free within 24 hours of application.

1.4 QUALIFICATIONS

A. Applicator Qualifications: Company experienced in application of dampproofing with 3-years experience on similar sized projects.

1.5 FIELD SAMPLES

A. Provide 4 x 6 foot field sample of mastic dampproofing under provisions of SECTION 01 45 00 - QUALITY CONTROL illustrating application techniques and material thickness.

B. Sample may be incorporated as part of work if approved in writing by Architect.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING PROTECTION.

B. Do not allow products to become frozen.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and surface temperature above 40°F. for 24 hours before application and continuously until mastic dampproofing has cured.

B. Do not allow dampproofed surfaces to be exposed to prolonged sunlight.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate installation in accordance with SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Do not begin work until substrate preparation is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mastic: ASTM D 1227, Type II, Class 1, semi-mastic asphaltic emulsion reinforced with non-asbestos fibers. Product/manufacturer; one of the following:
920AF Fibered Emulsion Mastic; Karnak
Sealmastic; W.R. Meadows, Inc.
MasterSeal 615; Master Builders Solutions by BASF

B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 ACCESSORIES

A. Mastic Dampproofing:
1. Emulsion Based Dampproofing: Non-asbestos fiber reinforced emulsion asphaltic compound, brush or spray consistency, meeting requirements of ASTM D 1227 or FS-4-1781.
2. Reinforcing Mesh; Treated glass fabric, woven design, 20 x 10 mesh.
3. Plastic Cement: Type recommended by manufacturer and compatible with dampproofing product, for trowel consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Do not apply when surface of ambient temperature is below 40°F., during inclement weather, or if surface is damp, dirty, or dusty.

C. Verify surfaces are solid and free of cracks, pits, rough or sharp projections.

D. Verify items which penetrate surface to receive dampproofing are securely anchored.

3.2 PREPARATION

A. Remove rough or sharp projections, loose particles, and foreign matter detrimental to adhesion and application of dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's written instructions.

C. Apply two coats of plastic cement and one layer of reinforcing mesh (between plastic cement coats) to seal penetrations, small cracks, and at other areas as recommended by manufacturer.

D. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at control joints.

3.3 INSTALLATION

A. Mastic Dampproofing: For application over concealed masonry, concrete surfaces, within walls.
1. Clean surfaces of excess mortar and loose dirt and apply the mastic in two coats by brush or spray. Allow the first coat to dry tacky before applying the second coat.

2. Coverage shall be approximately 35 sq.ft. per gallon per coat. Fill in crevices and grooves and around projecting anchors and joint reinforcement. Make sure that coating is continuous and free from breaks and pinholes.
3. At glass-mat gypsum sheathing, apply dampproofing prior to installation of masonry anchors.

3.4 FIELD QUALITY CONTROL

A. Tests: Periodically (not less than once per 100 sq.ft. of surface area) check application thickness to verify compliance with specified thickness. Immediately re-apply if found to be deficient.

3.5 PROTECTION

A. Protect finished installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

B. Protect adjacent surfaces not to receive dampproofing against "overspray" or "over brush".

C. Protect dampproofing against damage during backfilling with adhered protection course, neatly fitted around projections and penetrations. Do not apply until dampproofing has thoroughly cured.

D. Protect flashing until placement within wall is complete. Do not allow wind to displace or damage flashing.

3.6 CLEANING

A. Perform final cleaning under provisions of SECTION 01 74 13 - PROGRESS CLEANING.

3.7 DAMPPROOFING SCHEDULE

A. Dampproof as follows with mastic:
1. Over the exterior surfaces of the inside wythe of masonry and concrete backup in below-grade exterior cavity walls to provide an unbroken dampproofing barrier.
2. Over the inside wythe of masonry and concrete backup in non-conditioned buildings or dumpster walls.
3. Elsewhere where indicated.

END OF SECTION

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SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sheet membrane waterproofing.

B. Related Sections:
1. Section 32 05 19 - Geotextiles for Exterior Improvements.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include installation instructions, and general recommendations from waterproofing materials manufacturer.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than 5 years of successful experience in installation of waterproofing sheets similar to requirements for this project.

1.4 PROJECT CONDITIONS

A. Substrate: Proceed with work only after substrate construction, openings, and penetrating work have been completed.

B. Weather: Proceed with waterproofing only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

1.5 WARRANTY

A. Provide written 5-year warranty, signed by Contractor, installer, and manufacturer of primary waterproofing material agreeing to replace or repair defective materials and workmanship. Warranty includes responsibility for removal and replacement of other work which conceals sheet membrane waterproofing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Membrane: Self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 56 mils thick. Product/manufacturer; one of the following:
Bituthene; Grace Construction Products
Mel-Rol; W.R. Meadows, Inc.
Polyguard No. 650; Polyguard Products, Inc.

B. Drainage Mat: Reference SECTION 32 05 19 - GEOTEXTILES FOR EXTERIOR IMPROVEMENTS.

C. Protection Board: Organic fiberboard, treated for resistance to fungus and insects, asphalt impregnated and asphalt coated on both faces; ½" thickness.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrate and conditions under which waterproofing work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for handling and installation of sheet membrane waterproofing materials.

B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with recommendations of manufacturer. Schedule installation to minimize period of exposure of sheet waterproofing materials.

C. Extend waterproofing sheet to provide complete membrane over areas to be waterproofed. Seal to projections through membrane and seal seams.

D. Install protection board over completed membrane with close butt joints and cut to fit around projections.

3.3 PROTECTION

A. Provide for protection of completed membrane during installation of other materials or processes over membrane and throughout remainder of construction period.

END OF SECTION

SECTION 07 14 00

FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fluid applied elastomeric waterproofing:
   1. Vertical waterproofing below-grade.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 32 05 19 - Geotextiles For Exterior Improvements.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include membrane thickness, accessories, and method of application.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: This work shall be performed by an experienced applicator who has successfully applied the materials and used the methods specified under similar conditions over a period of at least five years.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the original, sealed containers or unopened packages clearly labeled with the manufacturer's name and the contents.

B. Store materials in a heated and ventilated area located away from all sources of sparks and open flame. Containers of liquid material shall not be left open at any time in the storage area.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Elastomeric Waterproofing: Provide a one-component, moisture-curing, bitumen-modified polyurethane elastomeric waterproofing membrane, containing no coal tar extenders. Provide formulation appropriate for chosen horizontal or vertical installation with associated trowel, squeegee, roller or spray application. Product/manufacturer; one of the following:
   MasterSeal HLM 5000; BASF
   MiraSEAL; Carlisle Coatings & Waterproofing Incorporated (CCW)

B. Flashing Membrane: Provide 1/16" thick neoprene synthetic rubber sheet.

C. Adhesive: Provide neoprene adhesive manufactured expressly for use with the synthetic rubber flashing membrane.

D. Drainage Mat: Reference SECTION 32 05 19 - GEOTEXTILES FOR EXTERIOR IMPROVEMENTS.

E. Protection Board: Provide a semi-rigid, asphalt saturated board ⅛" thick. Product/manufacturer: Type PC-2 Protection Course; W.R. Meadows.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose dirt and debris and clean off oil, grease, paint and other foreign contaminants to leave the concrete surface clean and dry. Immediately prior to and during application, remove dirt and dust from the surface with compressed air or a soft broom. Mask with paper and tape the surfaces not designated to receive waterproofing to protect them from accidental application of the waterproofing material.

3.2 INSTALLATION

A. Applying Waterproofing:
   1. Select the grade of product that best meets the individual job requirements.
   2. Mix the waterproofing compound thoroughly in conformance with the manufacturer's printed instructions.
   3. Horizontal Application: Apply product over horizontal surface in one coat using a roller, trowel, or squeegee as required to obtain thickness required. Pour the mixed compound onto the concrete floor and spread out with trowel and squeegee to a thickness of not less than 1/16". Coverage shall be not less than 4 gallons per square.
   4. Vertical Application: Apply one coat using a roller, trowel, or squeegee as required to obtain thickness required. Wait for material to film form and become stable between each coat.
   5. Install flashing membrane along perimeter walls. Install with adhesive applied to the concrete surface and to the back of the membrane. Press firmly into place without stretching and work out all bubbles, wrinkles and fishmouths. At walls in horizontal application, turn membrane up approximately 3" above the waterproofed surface to form a dam. Lap joints 3" and bond with adhesive.
   6. Over flashing membrane, apply a thin coat of neoprene adhesive and allow to dry until tacky before covering with the waterproofing compound. On metal pipes and conduits projecting through the concrete, apply a second coat of waterproofing compound after the first coat has cured. Extend the waterproofing into the floor drain flashing rings.
   7. For at least 24 hours after completion of the waterproofing, keep the area clear of all traffic. After testing for leaks, cover the waterproofing with protection board laid with close butt joints and cut to fit around projections and at offsets.

3.3 FIELD QUALITY CONTROL

A. Testing: Floor areas protected with elastomeric waterproofing shall be flood tested for leaks prior to installing the protection board. Plug the floor drains and flood the areas with water to a depth of 2" or more. Allow the water to stand for 24 hours before draining off. Repair all leaks.

END OF SECTION

SECTION 07 21 00

BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal, acoustical, and fire safing building insulations.

B. Related Sections:
1. Section 04 20 00 - Masonry Units.
2. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
3. Section 07 21 19 - Foamed-in-Place Insulation
4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers
5. Section 07 52 00 - Modified Bituminous Membrane Roofing; roof insulation
6. Section 07 65 00 - Flexible Flashing
7. Section 07 84 00 - Firestopping.

1.2 SUBMITTALS

A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Including performance specifications, composition and applicable standards.

C. Samples: Submit 12" x 12" size samples of each type insulation proposed for use.

D. Manufacturer's Instructions: Written installation instructions, including attachment recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: (See Articles below for specific products)
Dow Chemical Company
Johns Manville, A Berkshire Hathaway Co., Denver, CO
Owens Corning, Toledo, OH
Certainteed Corp., Valley Forge, PA
Thermafiber, Inc.
U.S. Gypsum Co.

2.2 BATT THERMAL INSULATION

A. Glass fiber composition, unfaced, minimum one lb./c.f. density, meeting following standards:
1. ASTM E 84: FHC 25/50 maximum.
2. ASTM C 518: R value of 3.2 per inch of thickness.
3. ASTM C 665: Type I and Type III, Class A.

B. Following products are acceptable:
1. Unfaced Thermal Batts by Owens Corning Fiberglas Corp.
2. Unfaced Building Insulation by Certainteed Corp.
3. Unfaced Building Insulation by Manville Corp.

2.3 RIGID INSULATION

A. Basis of Design: Provide Thermafiber RainBarrier 45 Insulation as manufactured by Thermafiber, Inc., Wabash, IN (phone: 888-834-2371; web: www.thermafiber.com (an Owens Corning company)
1. Description: Non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000° F, meets ASTM C 612, IVA**.**
2. Thickness: As noted on contract drawings.
3. Type:
a. R-value of min. 4.2 per inch.

b. Facing: Unfaced.
c. Density: 4.5 pcf.
d. Surface Burning Characteristics: Unfaced-Flame Spread 0 and Smoke Developed 0
e. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C 1104.
f. Non-corrosive, ASTM C 665.
g. Recycled Content for Standard Mineral Wool Products..……..…..…70%

B. Extruded polystyrene board insulation composed of rigid, cellular thermal insulation with closed cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84. R-value of 5 per inch.

C. Polyisocyanurate Board, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2. Rigid board insulation consisting of a glass-fiber-reinforced polyisocyanurate foam core laminated between aluminum foil facers.
1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.4 BATT ACOUSTICAL INSULATION

A. Unfaced glass fiber composition, 3½" thick, minimum one lb./c.f. density, meeting following standards:
1. ASTM E 84: FHC 25/50 maximum.
2. ASTM C 518: R value of 3.2 per inch of thickness.
3. ASTM C 665: Type I, Class A.

B. Following products are acceptable
1. Sonobatts by Owens Corning Fiberglas Corp.
2. Sound Control Batts by Certainteed Corp.

2.5 FIRE SAFING INSULATION

A. Mineral fiber composition, 4" thick, 4.0 pcf density, meeting following standards
1. ASTM E 84: FHC 15/10 maximum.
2. ASTM C 665: Type I, Class A
3. ASTM E 119: Testing Procedures.
4. FS HH-I-558B: Class 1 and 2.

B. Following products are acceptable
1. Thermafiber Safing Insulation by Owens Corning.
2. Mineral Wool Safing Insulation by Johns Manville.

2.6 ACCESSORIES

A. Joint Tape: Pressure sensitive type, recommended by insulation manufacturer.

B. Insulation Adhesive: Type recommended by insulation manufacturer.

C. Stick Clips
1. Galvanized sheet metal with impaling pins and retainer washers.
2. Size and type to suit application and insulation thickness.
3. Approved by manufacturer of insulation for intended use.

D. Stick Clip Adhesive
1. High strength, resilient adhesive, having drying time of 0 to 30 minutes (rapid initial set), and 24 hours final set.
2. Compatible with insulation adhesive, insulation and substrate.
3. Non-corrosive to galvanized steel.

E. Supportive Wire Mesh: Hexagonal design, woven mesh "chicken wire" style.

F. Tie wire: Minimum 18 ga. annealed wire.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive insulation for conditions that will adversely affect the execution and quality of the work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Fit insulation tight within stud spaces, above soffits, behind fascias, and tight to and behind mechanical and electric services within plane of insulation, leaving no gaps or voids. Butt insulation tightly. Cut and fit tightly around items penetrating insulation. Stagger and butt joints, or cavity of a cavity wall system.

B. Install in conformance with the manufacturer's recommendations. Cut material to fit closely around obstructions and projections.
   1. Walls: Secure insulation by mechanical means to hold it in place without sagging or slumping. Install insulation with edges and joints butted tight to leave no gaps.
   2. Soffits: Insulation shall be laid between wire hangers on back of cement plaster and over cross runners. Sides and ends of adjacent batts shall be tightly butted together.
   3. Acoustical Insulation:
      a. Install acoustical insulation between the studs in those gypsum drywall partitions so detailed and noted on the drawings. Staple blankets to the gypsum board or otherwise fasten in place as recommended by the manufacturer of the blankets. Fill all voids.
      b. Where indicated at suspended gypsum board ceilings, lay sound attenuation blankets between wire hangers on back of gypsum board and over cross runners. Do not install on top of or within 3" of light fixtures.

C. Applying Rigid Insulation: Install board insulation between the wythes in exterior masonry walls.
   1. In masonry walls place boards over the fluid-applied membrane air barrier on the face of the backup masonry before the face brick wythe is laid.
   2. Securely fasten the board to the backup with mastic and suitable mechanical anchors where required to hold it firmly in place.
   3. In framed construction, apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   4. Cut the material to fit snugly around obstructions and projections. Joints shall be tight.
   5. Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

D. Safing Insulation: Compress and install insulation on wire hangers or clips in spaces between floor slabs and curtain walls. Also, in openings in floor slabs to seal around telephone cables, piping, ducts and other utilities per SECTION 07 84 00 - FIRESTOPPING.

3.3 SCHEDULES

A. Provide R values for thermal insulation as indicated on the drawings.

B. Provide acoustical insulation in thickness and locations as follows:
   1. Walls: 3½" (or as shown on drawings)
   2. Above Ceilings: 3½" (or as shown on drawings)

END OF SECTION

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SECTION 07 21 19

FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Closed cell sprayed polyurethane foam insulation.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry.

1.2 SYSTEMS DESCRIPTION/QUALITY ASSURANCE

A. Contractor must use a total system, encompassing equipment, insulation, thermal barrier as supplied and tested by the manufacturer to meet IBC, IECC, and NFPA requirements. No substitutions may be made for tested systems.

B. Contractor must be licensed and trained by the manufacturer.

C. Manufacturer's qualified technical representative will be required to visit project site to advise Installer of procedures and precautions for installation of insulation materials and to verify installation requirements. Manufacturer's representative shall make inspection of the installation a minimum of three times. Manufacturer's written reports of findings shall be submitted for the Architect review.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data:
1. Submit data that the product meets or exceeds specified requirements.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Certification:
1. Submit current Manufacturer’s Authorized Contractor Certificate.
2. Submit manufacturer's certificate that the product meets or exceed specified requirements.
3. Manufacturer's written certification that product contains no asbestos.
4. Submit the technical data sheet from the manufacturer showing the test results from the ASTM E84 (Surface Burning Characteristics).

D. Samples: Submit samples of each product specified.

E. Mock-Up:
1. A representative surface of not less than 100 square feet shall be sprayed and approved by the manufacturer and Architect prior to proceeding.
2. Finish areas designated by Architect.
3. Do not proceed with remaining work until installation is approved by manufacturer and Architect.
4. Rework mock-up area as required to produce acceptable work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in original, unopened containers bearing name of manufacturer, product identification, safety information, and expiration date.

B. Store materials off ground, under cover and away from damp surfaces and keep material dry at all times.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction. Empty containers shall be removed from site on a daily basis.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Ventilate insulation application area in accordance with the Spray Foam Coalition's Guidance on best practices for the installation of Spray Polyurethane Foam.

C. Protect workers as recommended by the Spray Foam Coalition's Guidance on best practices for the installation of Spray Polyurethane Foam.

D. Protect adjacent surfaces, windows, equipment and site areas from damage of overspray.

1.6 WARRANTY

A. Provide limited lifetime warranty. Manufacturer's sole responsibility under this Limited Lifetime Warranty shall be to repair or replace any defective Product.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The following installation contractors are approved on this project as trained and certified by the Air Barrier Association of America (ABAA) and have received Demilec SPF training and certification.
LCR, Dallas, TX, Devin James, 214-761-1940, DJames@lcrcontractors.com
Alpha IBP, Dallas, TX, Chuck Jahant, 972-446-2600, CJahant@alphaiwp.com
True Fireproofing, Tulsa, OK, Dustin Norman, 918-346-1009, dnorman@truefireproofing.com
1. Allowance will be made for additional installers, provided they submit their name, certification by the manufacturer, experience, and information showing their proficiency to the Architect at least one week prior to the bid. Approval or denial will be issued by addendum.

B. Basis of Design: ASTM C 1029, Type II, provide thicknesses to meet R-values as shown on the drawings, Heatlok Soy® 200 Plus foamed-in-place insulation as manufactured by DEMILEC USA®; 3315 E. Division St., Arlington, TX 76011. (Phone: (877) DEMILEC or (817) 640-4900. Web: http://www.demilecusa.com)
1. Application with a prescriptive Thermal Barrier: Up to 9-1/4 inches for wall cavities with minimum 1/2 inch gypsum wall board or equivalent 15 minute thermal barrier in accordance with IBC 2603.4.
2. Application without a Thermal or Ignition Barrier (exposed foam): Passes NFPA 285 testing as part of an approved assembly.
   a. Up to 9-1/4 inches in walls and with all foam surfaces covered with BLAZELOK TBX intumescent coating.
   b. Up to 5-1/2 inches in walls with all foam surfaces covered with 12 dry mils of BLAZELOK TBX intumescent coating.
3. Physical Properties:
   a. Density (ASTM D 1622): 2.1 lb/cf.
   b. Thermal Resistance (ASTM C 518): Aged R value at 1 inch (180 days at 76 degrees F) – R-7.4 (sf.h degree F/BTU)
   c. Water Vapor Permeance @ 1.2"(ASTME 96-05): < 1 perms (is a vapor barrier per IBC Section 202 definitions at 1.2")
   d. Air Permeance @ 75 Pa @ 1" (ASTME 2178-03): 0.02 L/sm2
   e. Air Leakage of Air Barrier Assembly (static loading to 600 Pa and gust loading to 1,200 PA) Complies with ABAA requirements (ASTME 2357-05): <0.02L/sm2
   f. Compressive Strength (ASTM D 1621): 28.7 psi (198 kPa).
   g. Tensile Strength (ASTM D 1623): 46.2 psi
   h. Off Gassing Test (VOC Emissions) (CGSB 51.23-92): Pass (no toxic vapor).
   i. Surface Burning Characteristics (ASTM E 84) 4 inches: Class I. Flame Spread Index 20, Smoke Developed Index 400.
   j. Closed Cell Content (ASTM D2856) : >90%

C. Equipment used to apply the foam insulation shall have fixed ratio positive displacement pumps and approved by foam manufacturer.

D. Accessories:
1. Joint Cover Membrane: Membrane at Tilt-Wall Joints, Transitions in Substrate, and Connections to Adjacent Elements shall be 40 mil, minimum 9 inches wide, Heatlok® ABS Membrane.
2. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

E. Water Based Intumescent coating: Provide BLAZELOK™ TBX Intumescent Coating, Distributed by DEMILEC USA® and Manufactured by TPR^2.
1. Provide intumescent coating only when foam insulation is exposed to the building interior, plenums, attics or crawlspaces, except that no intumescent coating is required if the foam insulation is specifically approved based on large-scale tests such as, but not limited to, NFPA 286 (with the acceptance criteria identified in the International Building Code), FM 4880, UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use.
2. Application: Follow manufacturer's application recommendations.
3. Physical Properties:
a. Approval: Complies with NFPA 101 paragraph 10.2.3.7.2 for use without a prescriptive thermal barrier.
b. Surface Burning Characteristics (ASTM E 84): Class I. Flame Spread Index <25, Smoke Developed Index <50.
c. Expands up to 2000 percent.
d. Flash Point: None
e. Volatility/VOC: < 50 g/L
f. Non-toxic, drain safe, water based, non-fuming.
g. Color: Dull Flat White / Gray. Wait minimum 24 hours prior to top coating with quality latex paint. Verify dryness with moisture meter.

PART 3 - EXECUTION

3.1 INSPECTION

A. The installing contractor shall examine all surfaces and report all unsatisfactory conditions in writing to the Contractor. The work shall not proceed until unsatisfactory conditions are corrected. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

B. Surfaces to receive spray insulation shall be inspected prior to application to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains. Prime accordingly.

3.2 PREPARATION

A. Provide masking, drop cloths or other satisfactory coverings for all materials/surfaces which are not to receive insulation so as to prevent damage from overspray.

B. Clips, hangers, fasteners, supports, sleeves and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Area shall be dried-in before spraying insulation.

3.3 INSTALLATION

A. Installation, clean-up and curing shall be accomplished according to the manufacturer's recommendations and common construction standards.

B. Peel off silicone release paper or film from joint cover membrane. Membrane must be adhered to wall a minimum of 3 inches wide on either side of the joint. Once installed, a pressure must be applied over the whole surface using a hard roller to ensure a perfect adhesion.

C. Apply insulation to substrate in sufficient thickness to achieve the required thermal value.

D. Spray insulation to envelop entire area to be insulated and fill voids.

E. Spray insulation on wall and continue onto deck 4” to seal to deck. Tape area on deck to achieve a straight line.

F. Apply in multiple passes to reach specified R-Value (-0 / +1/4) and not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

G. Miscellaneous Voids: Apply according to manufacturer's written instructions.

H. Provide natural or mechanical ventilation continuously to properly cure the insulation.

3.4 PROTECTION

A. Protect installed products from damage due to harmful weather exposures, physical abuse, and other causes until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vapor-permeable, fluid-applied air barriers, which also function as water-resistive barriers.

B. Related Requirements:
1. Section 01 45 00 - Quality Control: for general mockup requirements.
2. Section 01 45 23 - Testing and Inspection Services: for coordination with testing agency.
3. Section 04 20 00 - Masonry Units; concrete unit masonry treatment.
4. Section 06 16 56 - Air and Water-Resistive Sheathing Board System: for vapor-permeable air- and water-resistive wall sheathing and associated site-fluid-applied air barrier flashing.
5. Section 09 21 16 - Gypsum Board Assemblies: for glass-mat gypsum wall sheathing and wall sheathing joint and penetration treatments.

1.2 DEFINITIONS

A. Air-Barrier Material (AB): A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

D. Water-Resistive Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, and installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.
1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.
4. Consult air barrier manufacturer for additional installation guidelines and illustrations to assist with meeting shop drawing requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
1. Installer(s) shall be accredited at the time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA) whose Installer(s) are certified in accordance with the site Quality Assurance Program (QAP) used by ABAA.

2. Installer(s) shall be certified by BPQI (Building Performance Quality Institute) for the ABAA Quality Assurance Program in accordance with the requirements outlined in the QAP program used by ABAA. Installers shall have their photo identification air barrier certification cards in their possession and available on the project site, for inspection upon request.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
1. Certification shall include statement that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.
2. Certification shall include statement that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
   a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
   b. Include junction with roofing membrane**,** building corner condition, and foundation wall intersection.
   c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
3. Water Penetration Testing: Mockups will be tested for water penetration according to ASTM E 1105.
4. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D 4541 (modified).
   a. Use a type II pull tester, except that the membrane shall be cut through to separate the material attached to the disc from the surrounding material.
   b. Perform test after curing period recommended by the material manufacturer.
   c. Record mode of failure and area where the material failed in accordance with ASTM D4541.
   d. The inspection report shall indicate whether the specified adhesion requirement has been met.
5. Compatibility Determinations: Mockups will be inspected for visual signs of decay, chemical attack, or degradation of any kind. Suspect instances shall be reported to the corresponding manufacturer who shall provide a letter that approves moving forward with the project or rejects the use of the product or rejects the method or circumstances of installation with an appropriate explanation of the position taken.
6. Notify Architect seven days in advance of the dates and times when mockups will be tested.

7. Perform the air leakage test and water penetration test of mockups prior to installation of cladding and trim but after installation of all fasteners for cladding and trim, and after installation of other penetrating elements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

C. Deliver materials to Project site in original packages with seals unbroken, labeled with material Manufacturer's name, product, date of manufacture, and directions for storage.

D. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material manufacturer.

E. Handle materials in accordance with material manufacturer’s recommendations.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

B. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

C. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.

D. Ultra-violet Exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which air barrier manufacturer agrees to furnish and install air barrier material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.
   1. Manufacturer’s Warranty Period: Five (5) years from Date of Substantial Completion.

B. Installer’s Warranty: Provide installer’s installation warranty, including all accessories and materials of the air barrier assembly, against failures including loss of airtight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.
   1. Installer’s Warranty Period: Two (2) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
   1. If the materials in this section are adjacent to the materials specified in Section 06 16 56 Air- and Water-Resistive Sheathing Board System, all materials in this section shall be compatible with the materials and products specified in that section and shall be approved by the air- and water-resistive sheathing board system manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft**.**, when tested according to ASTM E 2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.
   1. Basis of Design Product: Subject to compliance with requirements, provide Prosoco, Inc.; R-Guard Spray Wrap MVP (at medium-build thickness) or a comparable acrylic product by one of the following:
      Tremco, Inc.
      3M Industrial Adhesives and Tapes Division.
      DuPont Safety & Construction.
      GE Construction Sealants; Momentive Performance Materials Inc.
      Hohmann & Barnard, Inc.
      W.R. Meadows, Inc.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. Pecora Corporation.
      d. Prosoco, Inc.
      e. Tremco Incorporated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
   4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
   3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
   1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Where multiple prime coats are needed to achieve required bond or thickness, allow adequate drying time between coats.

B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 17 mils, applied in two equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
      a. Second coat shall be back rolled in accordance with manufacturer’s written instructions.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Air-barrier dry film thickness.
   3. Continuous structural support of air-barrier system has been provided.
   4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   5. Site conditions for application temperature and dryness of substrates have been maintained.
   6. Maximum exposure time of materials to UV deterioration has not been exceeded.
   7. Surfaces have been primed, if applicable.
   8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   9. Termination mastic has been applied on cut edges.
   10. Strips and transition strips have been firmly adhered to substrate.
   11. Compatible materials have been used.
   12. Transitions at changes in direction and structural support at gaps have been provided.
   13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   14. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

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SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Mechanically fastened, UL Class A, white granule surface, modified bitumen sheet roofing system installed over polyisocyanurate and perlite insulation and metal deck.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry: Treated wood nailers, blocking and curbs.
2. Section 07 59 00 - Roofing Repair**.**
3. Section 07 62 00 - Sheet Metal Flashing and Trim.
4. Section 07 72 13 - Manufactured Roof Curbs and Portals.
5. Section 07 72 33 - Roof Hatches.
6. Division 22 - Plumbing: Roof Drains.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
1. Furnish manufacturer's printed specifications and instructions for installation of system, include applicable temperature range.
2. Include procedures and materials for terminations, flashing, and expansion joints.

B. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Indicate roof configuration, sheet layout, mechanical equipment flashing, expansion joints, termination details, penetration details, parapet wall details, design of tapered insulation system showing layout, slope and thickness of entire system.

C. Sample: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit a 12" x 12" sample of membrane material and each type of fastener.

D. Certificates:
1. Submit manufacturer's certification stating materials ordered and supplied are compatible with each other, suited for locale and purpose intended, and shipped in sufficient quantity to ensure proper, timely installation.
2. Submit manufacturer's approval of proposed fasteners.
3. Submit manufacturer's approval of installer.
4. Submit installer's experience record.
5. Certify materials shipped to site meet membrane manufacturer's published performance requirements.
6. Stating that membrane manufacturer approves of insulation type and method of installation.
7. Indicating that materials specified and details shown conform with manufacturer's requirements for specified warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer:
1. Obtain primary sheet roofing materials from a single manufacturer.
2. Attend pre-installation conference.
3. Provide secondary materials as recommended by manufacturer of primary materials.
4. Manufacturer's qualified technical representative will be required to visit project site to advise Installer of procedures and precautions for installation of roofing materials and to verify warranty inspection requirements.
5. During installation, provide for 6 on-site inspections of roof application by qualified technical representatives of roofing manufacturer.
6. Upon completion of installation of the base ply, provide an interim inspection by a technical representative of roofing manufacturer to confirm that base ply has been installed in accordance with manufacturer’s requirements. Issue roofing manufacturer’s interim inspection document noting any deficiencies that need to be addressed prior to the cap sheet being installed.
7. Upon completion of roof system installation, provide a final inspection by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with

manufacturer's requirements. Issue roofing manufacturer's final completion checklist to Architect and Owner for review.

8. Provide primary products, including each type of flexible sheet roofing and sheet flashing produced by a single manufacturer, which has produced SBS modified bitumen product successfully for not less than 5 years. Provide accessory products which are acceptable to manufacturers of primary products.
9. Ponding Water: Areas which pond water in excess of the roofing system manufacturer's definition of acceptable standing or ponding water, shall be corrected by adding additional ply layers or by adding a coating to the mineral surfaced cap sheet in accordance with the roofing system manufacturer's written instructions in order eliminate any conditions that will result in warranty exclusion. This shall be done at no additional cost to the Owner. Contractor to monitor ponding and record readings every 2 hours or when conditions change. Contractor will have records available for review by owner.
10. Provide one copy of punchlist items to Architect once substantial completion is performed.
11. Install one roof sign in close proximately to the roof hatch or access ladder to notify maintenance of the roof system warranty period.

B. Applicator Qualifications: Five years successful experience in installation of roofing systems similar to system for this project and approved by membrane manufacturer.

C. Wind Up-lift Requirements: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressures calculated according to ASCE-7. Wind uplift pressures for this area, based on a 3-second gust of 90 miles per hour, are as follows:
   1. Zone 1 (roof area field): 90 pounds per sq. ft.
   2. Zone 2 (roof area perimeter): 90 pounds per sq. ft.
   3. Zone 3 (roof area corners): 90 pounds per sq. ft.

D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

E. Compatibility or Roofing System: Roof insulation, roof crickets and tapered roof insulation system shall be compatible with the roofing materials to be used and shall be approved by the manufacturer of the membrane roofing materials.

F. Pre-roofing Conference:
   1. At least one week prior to start of roofing installation, convene pre-roofing conference at project site.
   2. Attendance is required by Contractor, Installer, Manufacturer's Technical Representative, Architect, and Program Manager.
   3. Review requirements for work and conditions which could possibly interfere with successful performance of work.
   4. Minimum agenda:
      a. Review project specifications and drawings.
      b. Review weather and working conditions.
         1) Substrate requirements.
         2) Membrane installation.
         3) Roof terminations, flashings, and roof drain requirements.
         4) Mechanical equipment placement, supports, and height requirements.
         5) Inspection, testing, and quality control procedures.
         6) Protection requirements for construction period beyond roofing installation.
         7) Procedures for making roof penetrations after membrane installation.
   5. Conduct tour of roof deck; report discrepancies and problem areas to Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging with legible labels intact.

B. Store materials on site in enclosures or under protective coverings off ground.

C. Do not store material in or on building in such concentrations as to impose excessive strain on deck or structural members.

1.5 PROJECT CONDITIONS

A. Weather:

1. Proceed with roofing work when existing and forecasted weather conditions permit performance in accordance with manufacturer's recommendations and warranty requirements.
2. Take special precautions as recommended by manufacturer when applying roofing below 40°F. Ensure cements, adhesives, mastics, and coatings are not affected by freezing weather.

1.6 WARRANTY

A. Furnish written 10-year no dollar limit warranty of materials and workmanship for watertightness extended to include but not be limited to flashings, seams, membrane and penetrations.

B. Warranty shall be signed by membrane manufacturer, agreeing to repair or replace defects in material or workmanship and failure of roof to resist water penetration for a period of ten years from Substantial Completion of project with no dollar limit.

C. Special Project Warranty: Submit 2 executed copies of standard 2-year “Applicator's Roofing Guarantee” on form included at end of this section, covering work of this section including roofing membrane, composition flashing, roof insulation and roofing accessories, signed and countersigned by installer (roofer) and Contractor.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both surfaces. Polyisocyanurate insulation shall have a 2.0" max. thickness per board for a total installed thickness of 3".

B. Perlite Board Insulation: ASTM C 728; composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal-coated. Provide a single thickness of 3/4" of perlite insulation.

C. Crickets and Cants: Provide crickets and cants at locations as shown. Cricket and cant must be compatible with built-up roofing material.

D. Tapered Roof Insulation: Provide tapered roof insulation as required to fulfill slope requirements. Tapered roof insulation must be compatible with built-up roofing material. Provide of same material as top layer of insulation.

E. Steep Asphalt: ASTM D 312, Type III.

F. Mechanical Fasteners for Insulation: Screw type on metal deck, Tube-Nail type on light weight insulating decks, length required for thickness of material, with plastic washers and fluoropolymer finish, and approved by membrane manufacturer.

2.2 MODIFIED BITUMEN SHEET ROOFING MATERIALS

A. Product/Manufacturer: Provide SBS modified bitumen sheet roof system manufactured by Johns Manville ”Cool Roof Membrane”.
   1. Acceptable Manufacturers:
      a. GAF
      b. Siplast
      c. Derbigum

B. Multi-ply SBS modified bitumen roofing, consisting of an unsurfaced SBS sheet and reflective mineral surfaced SBS cap sheet, applied over venting base sheet mechanically attached over gypsum roof deck.

C. Roofing System Performance Requirements:
   1. Solar Reflectance Index (SRI) for exposed roofing: 78 minimum, calculated in accordance with ASTM E 1980.
      a. Field applied coating may not be used to achieve specified SRI.

D. Sheet Size: Maximum width and length of sheet possible as determined by project conditions and manufacturer's recommendations.

E. Base Sheet: As required by membrane manufacturer.

F. Flashing: Manufacturer's approved bonding adhesive for conditions encountered.

G. Base Flashing: DynaFlex as manufactured by Schuller Roofing Systems or approved equivalent.

2.3 RELATED MATERIALS

A. Bituminous Materials:
   1. As recommended by roofing sheet manufacturer for bonding to substrates and for waterproof sealing of seams.
   2. Asphalt Bitumen: ASTM D 312, Type III.
   3. Asphalt Primer: ASTM D 41.
   4. Flashing Cement: ASTM D 4586.

B. Fasteners: Provide fasteners as manufactured by or approved by membrane manufacturer for conditions encountered.

C. Accessories: Provide primers, adhesives, sealants, mastics, prefabricated pipe flashing, roof drain flashing, expansion joint flashing, and appropriate cleaning agents and solvents as recommended by membrane manufacturer for conditions encountered.

D. Expansion Joints: Provide expansion joint approved by the manufacturer where required by membrane system and as detailed on the drawings.

E. Walkway Protection: Provide walkway protection pads around all rooftop mechanical units and path leading to roof hatches and in accordance with manufacturer's standards.

2.4 ASPHALT FUME CONTROL

A. It is essential that the fumes resulting from the execution of this work be prohibited from entering any of the existing buildings on campus and minimized in the atmosphere around the campus in the exterior.

B. Contractor may elect any means of his choice to reduce the presence of asphaltic fumes, but the following are the minimum requirements:
   1. Conventional kettle application with approved fume recovery system.
   2. Enclosed tanker application with internal heating element and recycle fume recovery system.
   3. Extension of all existing air intake devices in effected areas to an upwind position.
   4. Providing emergency ventilation of any areas which become areas of complaints by the Owner.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine deck surfaces to receive insulation for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

B. Verify that deck is supported and secured.

C. Verify that deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

D. Verify that deck surfaces are dry and free of snow or ice. Verify flutes of metal deck are clean and dry.

E. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood cant strips and nailing strips are in place.

F. Examine surfaces scheduled to receive roofing to ensure that they are smooth, dry, and free from oils, grease, and conditions that will adversely affect execution, permanence, or quality of work.

G. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION OF SURFACES

A. Comply with manufacturer's instructions for substrate preparation.

B. Sweep surfaces upon which sheet is applied, removing loose and foreign materials.

C. Coat metal surfaces with primer or adhesive as recommended by manufacturer.

3.3 INSULATION INSTALLATION

A. Install first two layers (polyisocyanurate insulation) over all areas to receive roof insulation. Mechanically fasten one 2" thick layer and one 1" thick layer (or two 1-1/2” thick layers) of polyisocyanurate insulation.
   1. Apply first layer of insulation with long joints continuous and short joints staggered.
   2. Apply second layer (polyisocyanurate insulation) over first layer in broken joint pattern so that each layer breaks joints both ways with the preceding layer.

B. Apply third layer (perlite insulation) over first layer in broken joint pattern so that each layer breaks joints both ways with the preceding layer.

C. In areas to receive tapered roof insulation or crickets, apply over polyisocyanurate insulation only.

D. Bring insulation panels into moderate contact with each other and cope to fit neatly around projections. Joints parallel to ribs on steel deck installation shall be located over solid bearing.

E. Over steel roof decks, mechanically fasten insulation to the deck throughout. Spacing and number of fasteners shall meet current building code requirements and per ASCE 7 calculations.

F. Tapered roof insulation system and crickets shall be installed per manufacturer's instructions as required to meet current building code requirements and per ASCE 7 calculations.

G. Do not install more insulation at one time than the amount which can be covered with roofing the same day.

H. At the end of each day's work and after any other work stoppage, apply temporary water cutoffs in accordance with membrane roofing manufacturer's recommendations.

3.4 MEMBRANE INSTALLATION

A. General:
   1. Manufacturer's technical representative is required to be present as necessary to ensure proper installation. Install materials in accordance with manufacturer's printed instructions.
   2. Protect other work from spillage of roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace and restore other work damaged by installation of roofing system work.

B. Cutoffs:
   1. Coordinate installation of insulation, roofing sheets, flashings, stripping, coatings and surfacings, so that insulation and felts are not exposed to precipitation nor exposed overnight.
   2. Provide cut-offs at end of each day's work, to cover exposed felts and insulation with course of coated felt with joints and edges sealed with roofing cement.
   3. Remove cut-offs immediately before resuming work.
   4. Glaze coat installed ply-sheet courses at end of each day's work where final surfacing has not been installed.

C. Asphalt Bitumen Heating:
   1. Heat and apply bitumen in accordance with equiviscous temperature method ("EVT Method") as recommended by National Roofing Contractors Association and manufacturer.
   2. Maximum bitumen temperature in kettle: 500 degree F. or not to exceed FBT.
   3. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (±25°F. at point of application) more than one hour prior to time of application.
   4. Discard bitumen which has been held at temperature exceeding finished blowing temperature (FBT) for period exceeding three hours.
   5. Determine flash point, finished blowing temperature and EVT of bitumen, either by information from bitumen producer or by suitable tests, and determine maximum fire-safe handling temperature and do not exceed that temperature in heating bitumen.
   6. Do not heat bitumen to temperature higher than 25°F. below flash point.
   7. Keep kettle lid closed except when adding bitumen. Provide thermostatic controls and visible thermometer on kettle and maintain in working order and keep calibrated.
   8. Provide afterburner fume recovery systems on all kettles.

D. Substrate Joint Penetrations: Do not allow bitumen to penetrate substrate joints and enter building or damage insulation, or other construction. Tape insulation joints.

E. Membrane Installation:
1. Cut sheets to maximum size possible in order to minimize seams.
2. Roll an 18" wide piece of the base felt into a full mopping of bitumen. The remaining felts are to be applied full width, in the same manner, with 3" side and 4" end laps over the preceding sheets.
3. Roll the sheet out onto the deck over the base sheet, inspecting the membrane for defects as it is being rolled out. Allow membrane to relax for 1/2 hour before fastening or splicing. The sheet should be aligned so that it overlaps the previous sheet by the required lap width and then should be rerolled. A mopping of hot asphalt is then to be applied immediately in front of the roll. Roll the membrane into the hot bitumen in a manner that minimizes voids and wrinkles, taking care to ensure proper lap alignment. Membrane laps are sealed together as the sheet is being adhered to the deck. Laps should be fabricated to shed water wherever possible.
4. Lap adjoining sheets: 4" min. side laps, 6" min. end laps.
5. Apply all felts so that they are firmly and uniformly set, without voids, into the hot bitumen. All felt edges shall be well sealed. The bitumen shall be applied just before the felt, at a nominal rate of 25 lbs. per square. When applying over insulations, more than 25 lbs. per square of bitumen may be needed due to the absorbency of the insulation.
6. Install mechanical fasteners where required at spacings recommended by manufacturer.

F. Equipment Curbs:
1. Adhere membrane over equipment supports prior to installation of mechanical equipment.
2. Provide sealant over exposed fasteners.

G. Expansion Joints: Install expansion joints in accordance with manufacturer's recommendations

H. Cant and Tapered Edge Strips:
1. Install performed 45° insulation cant strips at junctures of roofing membrane with vertical surface.
2. Install tapered edge strips at perimeter edges of roofs which do not terminate at vertical surfaces.
3. Set in plastic cement.

I. Set-on Accessories: Where small roof accessories are set in roofing membrane, set metal flanges in bed of roofing cement, and seal penetration of membrane with bead of roofing cement to prevent flow of bitumen from membrane.
1. Flashing: Install 2 ply system consisting of unsurfaced ply sheet and mineral surfaced cap sheet in accordance with requirements of roofing system manufacturer, with each ply sheet extending full height of flashing.
2. Mechanically attach leading/top edge of flashings with continuous termination bars with fasteners installed 6 inches on center
3. Install where indicated where roofing systems abuts vertical surfaces at curbs.
4. Extend base flashing up rise walls as indicated above roofing membrane, up parapet walls full height of parapet, up curbs full height of curb and 4 inches onto field of roofing membrane.
5. Install flashings as indicated and recommended by manufacturer.
6. Use longest pieces practicable.
7. Extend splice 3" beyond fasteners which attach membrane to batten strip.
8. Take measures to assure flashing is not ridging where there is change of direction.
9. Fasten top of flashing under metal counterflashing at manufacturer's recommended spacing.
10. Flash penetrations passing through membrane.
11. Use factory prefabricated conduit seals where indicated.
12. When prefabricated pipe seals cannot be used, field fabricate pipe seals.
13. Install fillers around penetrations and fill pocket with non-shrink grout and manufacturer's approved sealer.

J. Roof Drains and Overflow Drains:
1. Fill clamping ring base with heavy coating of roofing cement.
2. Set lead flashing sheet in bed of roofing cement on completed roofing ply sheet courses, with lead sheet clamped in roof drain ring and extended 12" onto roofing.
3. Cover lead sheet with plies extended 4" to 6" beyond edges of lead sheet.
4. Install resin penetration flashings at plumbing vent and overflow drain penetrations in accordance with manufacturer’s directions, similar to Siplast Detail No. 2031giP1-PPI.
5. Prepare steel surfaces by sandblasting to bare metal. Prime surfaces with manufacturer’s recommended primers.

3.5 PUNCH LIST REQUIREMENTS

A. All roof system base flashings shall be a minimum of 10 inches, or as indicated, above the adjacent roof elevation. The height of all roof curbs shall take this requirement into consideration.
B. Provision of soldered corners on counter flashings installed at roof curbs. Installation of properly sized roof curbs.
C. Provision of solder joint on all thru wall scuppers. Continuous sealant installed on scupper escutcheon plates.
D. Installation of properly sized pipe supports for all roof level piping at 8 ft. o.c. maximum in linear direction and within 2 ft. of each change in direction. Provide pipe supports with rollers for all piping 1.25 inches or greater in diameter. All pipe supports are to be installed over an additional ply of modified bitumen cap sheet.
E. Provision of non-damaging pads for all equipment installed directly on the roof.
F. Provision of temporary roof protection by trades performing work over roof system with a minimum poly sheet and 5/8 in. plywood at work area and extends out for storage or prep of material being used. Limit storage of materials on roof.
G. Roof system base flashings shall not have aluminum cladding.
H. No penetrations thru base flashings unless resin flashings for such are approved by roofing manufacturer.
I. Installation of resin flashings in lieu of pitch pans or metal penetration dams at piping and conduit penetrations. All piping and conduit penetrations must be hard pipe or conduit and shall be properly anchored to deck.
J. Refrigerant line penetrations. Membrane to be peeled at refrigerant line penetration to determine flashing and sealed.
K. Avoid damage to roof from cutting oils, refrigerant oils, soldering, etc.
L. Provision of overflow provisions in conductor heads
M. Provisions of thru-wall flashings with weeps at all masonry rise walls that occur above roofing.
N. Provision of minimum 8 inch high roof system base flashings below windows that occur above roofing.
O. Overflow drains shall have their inlet elevations set at 2 inches above the inlet elevation for the primary roof drains.
P. Ponding water 48 hours after rain is unacceptable.
Q. New and replaced roof drain strainers to be metal and not plastic.
R. All gas legs should have 1 inch clearance from finish roof elevation.
S. Turn in all lead flashings at plumbing stocks a minimum of 1 inch.
T. Precast concrete splash blocks are required at locations where a given roof area discharges storm water onto a finished grade and stainless steel splash blocks adhered to a roof pad at any roof system elevation.
U. All condensing units are to be installed on pre-manufactured roof curbs with sheet metal curb caps.
V. Where required sumps are to be provided at all roof drains.
W. Roof penetrations shall not occur within 18 inches of any roof system base flashings.
X. Gutter expansion joints should be every 50 ft. maximum or as otherwise required.
Y. Roof to roof ladder supports must not penetrate copings. Any supports occurring in the roof system base flashings must be flashed with resin flashings.
Z. Clamping rings at drains must be properly secured.
AA. All fastener spacing should be 8 in o.c. maximum
BB. Provide isolation at support clamps for where dissimilar metals occur.
CC. All roof level gas piping shall b primed add
DD. Rise wall base flashings must not cover weep holes installed above thru wall flashings.
EE. Three course flashing and term bar anchored at 6 in. o.c. to be installed at all base flashings.
FF. At all cap sheet installations a maximum of one patch per membrane roll shall be considered acceptable.

3.6 TERMINATIONS

A. Provide water cutoffs at end of each day's work.

B. Pull membrane loose from water cutoff and remove contaminated material before resuming work.

3.7 WALKWAY PROTECTION

A. Install walkway protection pads as recommended by manufacturer.

END OF SECTION

ROOFING WARRANTY

WHEREAS _____

of (Address) _____

herein called the "Roofing Contractor", has performed roofing and associated work ("work") on following project:

Owner: _____

Address: _____

Name and Type of Building: _____

Address: _____

Area of Work: _____ Date of Acceptance: _____

Warranty Period: _____ Date of Expiration: _____

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

NOW THEREFORE Roofing Contractor hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in watertight condition.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by: a) lightning, windstorm; b) fire; c) failure of roofing system substrate including cracking, settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work; e) vapor condensation on bottom of roofing; and f) activity on roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

2. The Roofing Contractor is responsible for damage to work covered by this Warranty, but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

3. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Contractor, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void upon date of said alterations, but only to extent said alterations affect work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall have notified Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this warranty.

4. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void upon date of said change, but only to extent said change affects work covered by this Warranty.

5. The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect, or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work, and to examine evidence of such leaks, defects, or deterioration.

6. This Warranty is recognized to be the only warranty of Roofing Contractor on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Contractor of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

_____
Installation Company

_____
By

_____
Title

_____
Business Address

_____
Telephone Number FAX Number

ATTEST:

_____
Secretary

IN WITNESS THEREOF, this instrument has been duly executed this

_____day of _____, 20____.

(INSERT APPROPRIATE EXECUTION FORM)

* * *

SECTION 07 59 00

ROOFING REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Modified Bitumen Roof repair work as a result of penetrations made or damage occurring to the roof membrane and flashings as part of the work of this contract.
   1. In order to maintain the existing warranty where new roofing will be tied into existing roofing, the Contractor shall obtain written approval from the existing roof manufacturer.
      a. Existing built-up bituminous roof modified bitumen roof is under warranty with Johns Manville.

B. Related Sections:
   1. Section 07 55 52 - Modified Bituminous Membrane Roofing.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim.
   3. Section 07 72 13 - Manufactured Roof Curbs and Portals.
   4. Section 07 72 33 - Roof Hatches.
   5. Division 22 - Plumbing.
   6. Division 23 - Heating, Ventilating and Air Conditioning.
   7. Division 26 - Electrical.

1.2 SYSTEM PERFORMANCE

A. Flash, seal, counterflash and otherwise make watertight all roof membrane penetrations and repair all damages leaving membrane and flashings in a watertight condition.

1.3 SUBMITTALS

A. General: Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Shop Drawings: Indicate layout, details, dimensions and interface with adjoining work.

C. Product Data:
   1. Submit all data concerning each roof to be repaired.
   2. Submit written approval from the existing roof manufacturer that warranty shall be maintained.

1.4 QUALITY ASSURANCE

A. Installer: Company specializing in roofing flashing and repair work with minimum 3 years experience. Use recommended detailing as indicated in NRCA Roofing Manual.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials during inclement weather or when temperatures are below 40°F.

1.6 COORDINATION

A. Coordinate placement of curbs for roof mounted equipment with new openings cut into roof structure.

1.7 WARRANTY

A. Maintain existing warranties.

B. Provide a 2-year watertightness warranty from date of substantial completion for work of this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Utilize identical sheet, fluid-applied and bituminous materials, flashings, roof surfacing, fasteners, adhesives and accessories as original installation. On pipe penetrations, use flashing materials and techniques as recommended by NRCA utilizing portals mounted to curbs.

2.2 ASPHALT FUME CONTROL

A. It is essential that the fumes resulting from the execution of this work be prohibited from entering any of the existing buildings on campus and minimized in the atmosphere around the campus in the exterior.

B. Contractor may elect any means of his choice to reduce the presence of asphaltic fumes, but the following are the minimum requirements:
   1. Conventional kettle application with approved fume recovery system.
   2. Enclosed tanker application with internal heating element and recycle fume recovery system.
   3. Extension of all existing air intake devices in affected areas to an upwind position.
   4. Providing emergency ventilation of any areas which become areas of complaints by the Owner.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect existing building surfaces against damage from roofing installation.

3.2 PREPARATION

A. Prepare roof surfaces as recommended by manufacturer of original installation.

3.3 FLASHING AND REPAIR WORK

A. General: Perform work in strict accordance with instructions and recommendations of the manufacturer of original installation materials.

B. Cut holes for penetrations.

C. Lay base flashing and seal down to membrane and penetration.

D. Strip in flashing with multiple layers of felt and bitumen on built-up systems and with one layer of sheet material on single-ply systems.

E. Counterflash as required to make watertight.

F. On built-up systems, re-install surfacing into flood coat of bitumen.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sheet metal flashing and trim.

B. Related Sections:
1. Section 07 52 00 - Modified Bituminous Membrane Roofing.
2. Section 07 71 13 - Manufactured Copings**.**
3. Section 07 92 00 - Joint Sealants.
4. Section 09 91 00 - Painting.

1.2 SUBMITTALS

A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit for approval samples of parapet coping cover expansion joint and soldered joint.

1.3 QUALITY ASSURANCE

A. Standard: Comply with the requirements of the Architectural Sheet Metal Manual published by SMACNA.

B. Installer Qualifications: Company specializing in sheet metal flashing work with three years minimum experience in similar sized installations

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Stack pre-formed material to prevent twisting, bending, and abrasions, and to provide ventilation.

C. Prevent contact with materials which may cause discoloration or staining.

1.5 WARRANTY

A. Furnish to the Owner a written warranty providing the following without cost to the Owner.
1. Sheet metal roof flashings shall be maintained in normal repair and free of leaks for a period of 2 years from the date of acceptance of the roof.
2. At end of 2-year period, Owner and Contractor shall make final inspection of flashing work. Holes, breaks and other defects shall be promptly repaired at the Contractor's expense.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Metal: ASTM A 653
1. Roof top accessories, including but not limited to, expansion joint covers, flanges, and concealed counterflashings not visible from ground level shall be Coating Designation G90 Paint Grip, zinc coated (galvanized) copper-bearing steel sheet, mill-phosphatized ready to receive field finishing in accordance with SECTION 09 91 00 - PAINTING
2. Areas which can be seen from the ground level, including but not limited to, coping, edging, gutters, conductor heads, downspouts, and expansion joint terminations shall be prefinished fluorocarbon coating containing 70% Kynar 500. Colors shall be selected by Architect from Fluropon Standard colors as manufactured by Valspar.

B. Reglet: Two piece snaplock receiver, Per Figure 4-4C, SMACNA Manual, 8th Edition, of 24 gauge galvanized steel**.**

C. Underlayment: ASTM D 226, 30 lb/100 s.f. weight felt containing no additives corrosive to sheet metals.

D. Solder: ASTM B 32, made from block tin and pig lead (50/50) with no antimony.

E. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

F. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

G. Sealant: Two component polyurethane, non-sagging, sealant as specified in SECTION 07 92 00 - JOINT SEALANTS.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

I. Miscellaneous items such as nails and mastic shall be furnished as required by the conditions of use and must be of the best grade available.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, free from distortion and defects, to profiles indicated in accordance with SMACNA Architectural Sheet Metal Manual.

B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.

C. Form pieces in longest practical lengths.

D. Hem exposed flashings on underside ½"; miter and seam corners.

E. Solder and seal metal joints except those indicated or required to be expansive type joints. After soldering, remove flux. Wipe and wash solder joints clean.

F. Fabricate corners from one place with minimum 18" long legs; solder for rigidity; seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward ¼" and hemmed to form drip.

H. Fabricate flashings to allow toe to extend minimum 2" over wall surfaces.

I. Fabricate as much as possible in shop with machinery to eliminate as much hand tooling on the job as possible. Shop fabricate to allow for adjustments in the field for proper anchoring and joining.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

C. Verify membrane termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Install starter and edge strips, and cleats before starting installation.

C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

D. Install one layer of underlayment prior to installing copings.

3.3 INSTALLATION

A. General: Fabricate, assemble, and install sheet metal work in conformance with referenced standard.
   1. Make adequate provision for metal expansion and contraction without buckling or splitting. Use cleats and watertight slip and expansion joints.
   2. Nails and screws shall be of the same metal as the member on which used. Nails through exposed wash surfaces will not be permitted.
   3. When soldering, use flux and wash off surplus flux after soldering has been completed.
   4. Set sheet metal with horizontal lines straight and level. Surfaces shall be flat without wrinkles and waves. Profiles shall align at joints with no offsets.
   5. Conform to drawing details included in manuals published by SMACNA and NRCA.
   6. Edge Securement for Low-Slope Roofs: Design in accordance with ANSI/SPRI ES-1 for basic wind speed zone with 3-second gusts.
   7. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
   8. Seal metal joints watertight.
   9. Provide electrolytic separation between dissimilar metals with protective back paint.

B. Reglet: Install surface mounted reglets on walls.
   1. Clean surface of oil, grease and loose particles.
   2. Place sealant bead on back in groove and on lap.
   3. Secure reglet in precise alignment to wall with power driven pins spaced 12" o.c.
   4. Lap joints 3" and bed in sealant. Miter and seal corners.

C. Reglet Counterflashing: Counterflashing for reglet shall be formed of 24 gage metal to fit the reglet in conformance with the manufacturer's instructions.
   1. Lap counterflashing down over flashing strip approximately 4" and form lower edge with a spring bend against the base flashing.
   2. After roofing and flashing strip have been installed, snap counter-flashing up into reglet so that it is held securely in place without screws or clips.
   3. Lap end joints 3" and bed in sealant. Miter and seal corners.

D. Parapet Coping Cover: Form and install coping covers and fascia covers of 24 gage metal. Finish coping covers with a fluorocarbon coating containing 70% Kynar 500. Color shall be selected from Fluropon Standard colors as manufactured by Valspar.
   1. Make up the coping in 10 ft. lengths.
   2. Bend outside bottom edge to form drip and lock to continuous cleat, 22 gage min., secured to wood blocking with nails and to masonry with screws into expansion shields.
   3. On roof side copings shall be fastened through slotted holes located 2' o.c. with screws and watertight washers.
   4. Provide loose-locked expansion joints filled with sealant where each 10' section meets. Provide an expansion joint within 10 ft. of each corner.
   5. Corners shall be mitered, locked and soldered seams.

E. Scupper: Form and install scuppers of 24 ga. metal through the parapets.
   1. Form scuppers with outside edges hemmed and flanged.
   2. To inside of scupper lock and solder an apron extending out over the cant each side, down the cant to the roof at the bottom, and up under the counterflashing at the top.
   3. Set scupper in roof cement with apron flanges on top of the roofing membrane.
   4. Strip the apron flanges with base flashing as specified in SECTION 07 55 52 - MODIFIED BITUMINOUS MEMBRANE ROOFING.

F. Vent Stack Roof-Penetration Flashing: Flashing shall have a weight range of 2 – 4 lbs/sq. ft. Coordinate installation of roof-penetration lead flashing flange with installation of roofing and other items penetrating roof. Base flashing shall be flanged 4 in. onto the roof. The flange is fastened through the roofing felts and is then stripped in by the roofer. Turn the top of the flashing down inside the vent pipe. Seal with sealant per Section 07 92 00 – Joint Sealants, and clamp flashing to pipes that penetrate roof.

G. Roof Expansion Joint Cover: Form and install the continuous covers and flashing required to make the roof expansion joints watertight.
   1. Install covers over the ice and watershield on wood curbs and nail flanges to the wood curbs in accordance with roofing membrane manufacturer's instructions.
   2. Strip the flanges with base flashing as specified in SECTION 07 55 52 - MODIFIED BITUMEN SHEET ROOFING.
   3. At wall intersections, nail upper vertical flange to wall just below receiver reglet and seal top edge and nail heads with roof cement.
   4. Faced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation In-fill: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on both faces, 1-1/2" thick.
   5. Vapor Retarder: Vapor retarder membrane shall be 45 mils EPDM, minimum 24" roll width. Drape vapor retarder down into expansion joint the full depth of the joint, and secure to face of wall and to top of expansion joint curb. Install in continuous length, without joints. Install in-fill insulation per detail.
   6. Ice and Watershield Underlayment: Provide Ice & Watershield self-adhered roofing underlayment as manufactured by Grace Construction Products. Extend membrane over expansion joint opening and secure to face of wall and front face of expansion joint curb nailer with screws (do not secure to top of curb).
   7. Splice joints and intersections of covers in accordance with the manufacturer's instructions.

H. Roof Equipment Screens: Form and erect the metal panels with battens for the equipment screens as detailed to match existing screens in profile and general appearance. Finish screens with a silicone polyester coating. Provide custom color to match existing screen color.

I. Gravel Guard: Form and install guards of 24 gage metal at roof edges.
   1. Make up gravel guards in 10 ft. lengths.
   2. Install over the roofing membrane in a bed of roof cement and nail flange with nails spaced in staggered pattern 6" o.c. near the back edge.
   3. Secure the bottom drip edge with concealed cleats at 12" centers.
   4. Strip horizontal flange with base flashing as specified in SECTION 07 55 52 - MODIFIED BITUMINOUS MEMBRANE ROOFING.
   5. Lap end joints 8" and bed in roof cement. Miter and seam solder the joints at corners.

J. Miscellaneous flashings and other items of sheet metal roof work shall be provided as required for a weathertight job.

END OF SECTION

SECTION 07 65 00

FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concealed through-wall flashing system.

B. Related Sections:
1. Section 04 20 00 - Masonry Units.
2. Section 05 40 00 - Cold-formed Metal Framing.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System.
4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.

1.2 GENERAL

A. Contractor shall review American Concrete Institute 530.1 mandatory specification checklist for additional requirements necessary for specific project.

1.3 QUALITY ASSURANCE

A. At a scheduled pre-construction meeting with all trades, contractor shall review flashing for the project and how the flashing shall be sequenced with the following: below grade waterproofing, air and vapor system, window installation, sealant installation, relief angles and roofing.

1.4 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Contractor shall provide from the manufacturer a review of the flashing design for the project and location of preformed shapes on reduced floor plan.

C. Product Certificates: From flexible flashing manufacturer, certifying compatibility (including adequate adhesion) of flexible flashing and accessory materials with Project materials that connect to or that come in contact with flexible flashing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be a minimum of four inches (4") off the substrate, and the tarpaulin tied off with rope.

C. Deliver materials in sufficient quantity to allow continuity of work.

D. Handle and store material in such a manner as to avoid damage.

E. Protect materials against damage by construction traffic.

F. Storage: All materials should be stored under cover to avoid site damage. During cool weather construction, store materials inside at 50º F or higher.

G. The proper storage of materials is the sole responsibility of the contractor and damaged materials shall be discarded, removed from the project site, and replaced prior to application.

1.6 SITE CONDITIONS

A. Job Condition Requirements: Coordinate the work of the contractor with the work to be performed by the Owner's personnel, to ensure proper sequencing of the entire work. The contractor shall follow local, state, and federal regulations, safety standards, and codes. When a conflict exists, use the stricter document.

B. Protection of Work and Property:
   1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. He shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations shall be fulfilled by the contractor as part of his proposal.
   2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the work of this contract. Examples of two categories or degrees of protection are generally as follows:
      a. removal, protection, preservation, or replacement and replanting of plant materials;
      b. protection of plant materials in place, and replacement of any damage resulting from the contractor's operations.

C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds shall be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.

D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.

E. Cleaning and Disposal of Materials:
   1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean.
   2. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust. At completion, all work areas shall be left clean and all contractor's equipment and materials removed from the site.
   3. Debris shall be deposited at an approved disposal site.

PART 2 - PRODUCTS

2.1 SURFACE-ADHERED FLASHING MEMBRANE (ELVALOY® SHEET)

A. Surface-adhered membrane shall be a composite 40 mil membrane consisting of 25 mils of elastomeric/thermal plastic membrane incorporating DuPont™ Elvaloy® and 15 mils of SBS asphaltic adhesive. The membrane shall be reinforced with synthetic fibers, calendered into sheet form, rolled and cut to standard widths.

B. Standard Sheet Dimensions:

	Thickness	40 mil
	Roll length	75 ft
	Roll widths	12, 18, 24, 36 in

C. Cloaks shall be pre-formed, three dimensional flexible units used for detail corners, level changes, stop ends, and special applications.

Physical Properties		
Elongation	225%	ASTM D412
Tensile Strength	875 psi	ASTM D412
Tear Strength	270 psi	ASTM D624
Low Temperature Flexibility	-25º F Pass	ASTM D146
Water Absorption	Less than 0.1%	ASTM D471

2.2 RELATED MATERIALS FOR SURFACE ADHERED FLASHING MEMBRANE

A. Double-Sided Tape: Shall be a two-sided, self-adhering tape used to seal the top of cloaks against the back-up wythe. Adhesive may be used as an alternative.

B. Mastic: Shall be used at all laps and joints, and top terminations.

C. Termination Bars for Flexible Flashing: Stainless steel bars 1/8” x 1”.

D. Drip Plate: Type 304 stainless steel, 26 ga., 3-1/2” drip plate with prefabricated inside/outside corners and end dams. Basis of Design shall be Hohmann & Barnard #DP.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and other specific conditions.

3.2 GENERAL

A. Laying Masonry Walls: Use an inverted lintel CMU or fully grouted hollow CMU as a base for flashing at sills, floor joints, and other similar conditions.

B. Preparation: All sharp protrusions and mortar droppings must be removed from the substrate, and the surface must be clean and dry.

C. Where brick work occurs about the roof elevation, provide solid protection of the existing roof system until work is complete.

3.3 INSTALLATION OF SURFACE-ADHERED FLASHING MEMBRANE (ELVALOY® SHEET)

A. Priming: If the surface-adhered flashing membrane will not adhere to the substrate or the substrate is dusty or dirty, the area shall be primed. Flashing primer shall be applied with a brush, roller or sprayed. Coverage is approximately 400 square feet per U.S. gallon (3.78L). Drying time may vary depending on temperature, humidity, and air movement; drying time should be approximately 45 minutes.

B. Flashing System Installation: Starting at a corner, mount cloak to substrate using double-sided tape or flashing adhesive. Cut surface adhered membrane into workable sections (8'-10'). Remove the release sheet and adhere the membrane to the inner leaf of construction lapping the membrane onto the cloak four inches (4"). Use firm hand pressure and a steel roller to totally adhere membrane in place. Extend membrane completely through the outer leaf and leave it exposed ¼" minimum. The surface-adhered membrane is not UV sensitive. Apply a bead of flashing mastic to all top termination edges.

C. Termination Bar: The surface-adhered membrane shall be installed using a termination bar for additional attachment to the inner leaf.

D. Weep holes shall be provided immediately above all flashing at 24-inch centers. A minimum of two baffle weeps shall be installed above any wall opening.

E. Flashing membrane shall be installed six inches (6") above top of cavity drainage material.

F. Stop end cloaks shall be installed at all windows, door heads, sills, and through-wall starts, stops, steps, etc.

G. Enveloped vertical flashing at wall openings shall extend into the wall opening one inch (1"). The door/window frame shall be installed with the flashing extending into the frame. Enveloped vertical flashing shall be installed at all abutments of dissimilar exterior wall treatments: inside and outside nineties (90°), etc.

H. Cleaning: Flashing membrane shall not be damaged by cavity cleaning after installation. Precautions to be taken during subsequent work are:
   1. Use of cavity battens to prevent mortar droppings;
   2. Removal of droppings before they harden;
   3. Never use implements such as steel rods for cleaning the cavity; and
   4. Inspection of cavity flashing for damage as the work proceeds.

3.4 FLASHING SCHEDULE

A. Flashing as follows with membrane:
   1. Over steel lintels, plates and angles in exterior masonry walls.
   2. Within masonry parapets and walls as through flashing to detail.
   3. At the bottom of cavity walls with weep holes.
   4. Under window sills to detail.
   5. Elsewhere in walls where indicated.

END OF SECTION

SECTION 07 72 13

MANUFACTURED ROOF CURBS AND PORTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefabricated roof curbs and penetration portals.

B. Related Sections:
1. Section 05 31 00 - Steel Decking.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00 - Rough Carpentry: Field-constructed curbs and cants.
4. Section 07 59 00 - Roofing Repair.
5. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashings and counter-flashings.
6. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Indicating technical and performance data of products.

C. Shop Drawings: Indicating details of special connections and transitions, typical section details, and layout showing intended locations for use of products.

D. Manufacturer's Instructions: Printed instructions for recommended installation methods and sequences for all products.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in the manufacturing of prefabricated roof expansion joints for a minimum of 5 years.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Acceptable Products and Manufacturers
1. Roof Curbs: RPS Expansion Curbs (EC-2B, with 2" extended flange), Roof Curbs (RC-2B) and Equipment Rail (ER-2B) by Roof Products and Systems Corp., Bensenville, Illinois.

B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 SIZES AND CONFIGURATIONS

A. Provide in sizes and configurations as required to accommodate joint widths, penetrations, and equipment being supported.

B. Provide configurations and special transitions as shown or required to utilize factory formed pieces wherever possible.

C. Provide custom factory-formed pieces conforming to roof slope to allow for a level equipment installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Verify that curbs are level and flashing reglets have been installed at proper locations.

C. Verify that insulation has been packed into joint prior to beginning work.

3.2 INSTALLATION

A. Interface with other systems. On roof mounted expansion joints, set flanges in adhesive and make watertight over cant strip.

B. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

C. Anchor units securely with fasteners and at spacing as recommended by manufacturer.

D. Where metal surfaces are to be in contact with corrosive substrates, apply bituminous coating on concealed metal surfaces.

E. Splice sections of curbs together with procedures as recommended by manufacturer for a solid, watertight installation.

F. Penetrations of piping through equipment curbs shall not be permitted.

G. Utilize factory fabricated intersections and transitions wherever possible. Field fabricate where pre-manufactured sections are not available.

3.3 PROTECTION

A. Protect completed installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

END OF SECTION

SECTION 07 72 33

ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Roof hatches, including ladder safety post and hatch rail system.

B. Related Sections:
1. Section 05 31 00 - Steel Decking.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00 - Rough Carpentry.
4. Section 07 55 52 - Modified Bituminous Membrane Roofing.
5. Section 07 62 00 - Sheet Metal Flashing and Trim: flashing of the hatch curb.
6. Section 07 72 13 - Manufactured Roof Curbs and Portals.
7. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include complete manufacturer's catalog cuts and installation requirements for each item specified.

1.3 WARRANTY

A. Provide manufacturer’s standard warranty. Materials shall be free from defects in material and workmanship for a period of:
1. Roof Hatch: Five years.
2. Ladder Extension: Five years.
3. Roof Hatch Rail System: 25 years.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

A. Roof Hatches: Provide single leaf roof hatches, 2'-6" x 3'-0", of 14 gage galvanized/galvannealed steel with 22 gage galvanized/galvannealed steel liner. Product/manufacturer; one of the following:
Model No. BRHU; Babcock-Davis Hatchways Inc.
Type S-20; The Bilco Co.
Model No. SAH-CM-12; Bristolite Daylighting Systems
Model No. RB-1; Milcor Limited Partnership
Model No. RHU; Nystrom

B. Construction:
1. Hatch shall be factory assembled with heavy pintle hinges, compression spring operators, positive snap latch with turn handles, padlock hasps and neoprene draft seals.
2. Curb shall be 12" high with 3½" flanges, fully welded at corners and equipped with integral metal cap flashing.
3. Cover shall be insulated with concealed 1" thick fiberglass insulation.
4. Curb shall be insulated with 1" thick high-density fiberglass insulation. Fiberboard insulation is not acceptable.
5. Cover shall have an automatic hold-open arm with red vinyl grip handle. All hardware shall be cadmium plated.

2.2 LADDER EXTENSION

A. Basis of Design: Provide ladder extension Model LU-2, “LadderUP” Safety post as manufactured by The Bilco Company.
1. 42" high telescoping extension.
2. Post shall lock automatically when fully extended. Release lever shall disengage the post to allow it to be returned to its lowered position.

3. Adjustable mounting brackets shall fit ladder rung spacing and clamp brackets shall accommodate ladder rungs.
4. Balancing Spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lower the safety post.
5. Hardware: All mounting hardware shall be Type 316 stainless steel.
6. Finish: Factory finish of post shall be hot dipped galvanized steel.

2.3 ROOF HATCH RAIL SYSTEM

A. Basis of Design: Where noted on drawings, provide roof hatch rail system Model RL-S as manufactured by The Bilco Company.
   1. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
   2. Posts and rails shall be round pultruded reinforced fire retardant fiberglass treated with UV inhibitor.
   3. Hardware shall be Corrosion resistant construction. Mounting brackets shall be 1/4" thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.
   4. Self-closing gate.
   5. Color: Safety yellow shall be molded in.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that ladder safety post or hatch rail system installations will not disrupt other trades.

B. Verify that the ladder rungs are dry, clean, and free of foreign matter.

C. Report and correct defects prior to any installation.

3.2 INSTALLATION

A. Roof Hatch: Install roof hatches in accordance with the manufacturer's recommendations. Securely fasten to the roof deck with bolts or screws.

B. Roof Hatch Railing System: Hatch rail system shall attach to the cap flashing of the roof hatch and shall not penetrate any roofing material.

C. Installer shall field check conditions and verify the manufacturer’s ladder safety post and hatch rail system details for accuracy to fit the application prior to fabrication.

D. Installer shall comply with the ladder safety post and hatch rail system manufacturer’s installation instructions.

E. The manufacturer shall furnish fasteners necessary for installations.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Firestopping for all fire-rated construction complete, including, but not limited to:
   1. Firestopping in conjunction with gypsum board, masonry and plaster partitions.
   2. Firestopping shall include, but not be limited to the following applications:
      a. Sealing gaps between tops of partitions and roof/floor decks.
      b. Sealing gaps between structure and glass curtainwalls with fire safing insulation.
      c. Other locations where "firestopping", "firestop", or "safing" is indicated.
      d. Where required by codes.
      e. Control joints and expansion joints in masonry or gypsum board fire-rated partitions.
      f. Expansion joints in roof and floor assemblies.

B. Related Sections:
   1. Section 04 20 00 - Masonry Units.
   2. Section 07 21 00 - Building Insulation.
   3. Section 07 92 00 - Joint Sealants.
   4. Section 09 21 16 - Gypsum Board Assemblies.
   5. Divisions 23 and 26.

1.2 SUBMITTALS

A. Refer to SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit copies of manufacturer's literature. Include data substantiating that materials comply with specified tested system requirements.

C. Samples: Submit duplicate samples of each type of firestopping material and accessories.

D. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgement derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow requirements set forth by the International Firestop Council.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Do not allow firestopping materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection.

1.4 PROJECT CONDITIONS

A. Do not install firestopping materials until building is completely enclosed and weathertight.

B. Coordinate installation with the work of other trades. Reference SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

PART 2 - PRODUCTS

2.1 PRODUCT/MATERIAL PERFORMANCE REQUIREMENTS

A. Except as otherwise indicated, firestop materials shall be classified in the Underwriters Laboratories (UL) Building Materials Directory, "Section XHEZ-Through-Penetration Firestop Systems", and/or "Section XHHW-Fill Void or Cavity Materials", and “Section XHBN - Joint Systems” for specific project conditions:
   1. Time rating ("F", Fire and "T", Temperature) (T-rating is only required for construction joint systems).
   2. Floor or wall assembly and material.
   3. Penetrating materials/items diameters, or void space.
   4. Through opening size.

5. Annular space between penetration opening and penetrating item.

B. Firestopping materials shall provide a fire-rating commensurate with the adjacent construction rating.

C. Firestop materials shall comply with ASTM E 84: Surface Burning Characteristics.

D. Firestop materials shall have been tested in accordance with ASTM E 814, UL 1479 or UL 2079.

E. Firestop materials shall be free of asbestos.

F. Firestop materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.

G. Obtain firestop products from a single manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine substrate and conditions under which firestopping work is to be performed, and notify Contractor in writing of any unsatisfactory conditions.

3.2 INSTALLATION

A. Install firestopping materials including foaming, packing and accessory materials to fill openings around penetrations in floors and walls, to seal gaps between decks and partitions, gaps between structure and curtainwall, etc., to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Use silicone based materials for all wet or damp conditions.

B. Install firestop materials and systems in accordance with manufacturer's printed instructions and applicable UL Building Materials Directory assemblies.

C. Cut and friction fit fire safing type insulation firestopping to completely fill all gaps and voids. Provide stick-clips, sheet metal closures, and any other accessories to support insulation.

D. Where floor openings are 4" or more in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

E. Remove damming materials after curing if made of other than fire resistant materials.

F. Protect materials from damage on surfaces subject to traffic.

3.3 FIELD TESTING

A. Firestop materials and installation may be tested by an independent testing laboratory. Refer to SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

3.4 CLEAN UP

A. Clean up all debris caused by the work of this Section, keeping the premises clean and neat at all times.

B. Clean adjacent surfaces soiled by the work of this section.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sealing and caulking of joints.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 04 20 00 - Masonry Units.
3. Section 06 40 00 - Architectural Woodwork.
4. Section 07 62 00 - Sheet Metal Flashing and Trim.
5. Section 07 84 00 - Firestopping.
6. Section 08 80 00 - Glazing.
7. Section 09 21 16 - Gypsum Board Assemblies.

1.2 SUBMITTALS

A. Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, color availability and application instructions.

C. Submit two samples ¼" diameter x 4" in size illustrating color selections available.

D. Submit manufacturer's certificate under provisions of SECTION 01 45 00 - QUALITY CONTROL that products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

B. Applicator: Company specializing in applying the work of this section with minimum 3 years documented experience and approved by sealant manufacturer.

C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.4 FIELD SAMPLES

A. Provide samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Construct one field sample joint, 5 feet long, illustrating sealant type, color, and tooled surface.

C. Locate where directed.

D. Accepted sample may remain as part of the work.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: No caulking shall be done at temperatures below 40°F.

1.6 WARRANTY

A. Furnish to the Owner a written warranty that the sealants shall remain watertight for a period of 2 years from the date of acceptance of the building. Joints which prove defective by leaking, cracking, melting or shrinking of the sealant shall be re-sealed without additional expense to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reference “SEALANT SCHEDULE” at end of this specification section for locations of Sealant Types.

B. Modified Polyurethane (Type 1 Sealant):
1. Two or three-part conforming to ASTM C 920, Type M, Grade NS, Class 25.
2. Color: Custom colors as selected by Architect.
3. Acceptable products:
MasterSeal NP2, BASF the Chemical Company
Dymeric 240FC, Tremco.

C. Pourable Urethane (Type 2 Sealant):
1. Multicomponent conforming to ASTM C 920, Type M, Grade P (pourable), Class 25, Use T (traffic).
2. Color: Custom color as selected by Architect.
3. Acceptable products:
Urexpan NR-200, Pecora Corp.
MasterSeal SL 2 Sealant; BASF the Chemical Company
THC 900 (Self leveling) or 901 (low sag), Tremco.

D. Pourable Urethane Sealant (Type 3 Sealant):
1. Single-component conforming to ASTM C 920, Type S, Grade P (pourable), Class 25, Use T (traffic).
2. Color: Gray or limestone as selected by Architect.
3. Acceptable products:
Sikaflex - 1CSL; Sika Corporation, Inc.
MasterSeal SL 1; BASF the Chemical Company
Vulkem 45; Tremco

E. Silicone, General Purpose (Type 4 Sealant)
1. One-part rubber based silicone conforming to ASTM C 920, Type S, Grade NS, Class 100/50.
2. Color: As selected by Architect.
3. Acceptable products
790 Building Sealant, Dow Corning.
SCS2700 Silpruf LM, GE Silicones.
Spectrem 1, Tremco.

F. Polyurethane Hybrid, Paintable (Type 5 Sealant):
1. One-part, moisture-cure, polyurethane hybrid sealant for interior use, conforming to ASTM C 920, Type S, Grade NS, Class 35 and Fed. Spec TT-S-00230C, Class A, Type II.
2. Acceptable product:
Dymonic FC, Tremco

G. Silicone, Sanitary (Type 6 Sealant):
1. One-part conforming to ASTM C 920, Type S, Grade NS, Class 25, F.D.A. Regulation 21 CFR177.2600, and FDA Food Additive Regulation 121.2514.
2. Color: Clear.
3. Acceptable products:
786 Silicone Sealant - M, Dow Corning.
SCS1700 Sanitary, GE Silicones.

H. Acrylic Latex (Type 7 Sealant)
1. One-part, non-sag acrylic latex, siliconized, conforming to ASTM C 834, Type P, Grade NF.
2. Acceptable products:
AC-20+, Pecora Corp.
MasterSeal NP 520; BASF the Chemical Company
Tremflex 834; Tremco.

I. Acoustical Sealant (Type 8 Sealant):
1. Butyl rubber for concealed locations.
2. Acceptable products:
AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
Acoustical Sealant, Tremco
Sheetrock Acoustical Sealant; USG Co.

J. Sealant (Type 10 Sealant): Reference SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

K. Silicone Sealant (Type 11 Sealant):
1. ASTM C 1184, One-part, neutral-cure, silicone sealant.
2. Color: Clear.
3. Product/manufacturer:
Dow Corning® 995 Silicone Structural Glazing Sealant.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D 1056 and C 1330. In vertical joints use closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width. In horizontal joints, use solid neoprene or butyl rubber, Shore A hardness of 70.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

A. Joint surfaces shall be clean and dry. Remove loose mortar and other material completely with compressed air or by brushing.
1. Joints to be caulked shall be at least ¼" wide unless specifically specified smaller. At any point where the width of the joint is appreciably less, cut or grind out the joint to that width to assure an adequate volume of sealant along the length of the joint, except at concrete paving joints, those shall remain ⅛" wide as indicated.
2. Pack with backing material the voids and recesses around metal frames which are deeper than the depth required for caulking. Leave the proper depth for the sealant.
3. In open joints and where detailed, install rod stock as backing material. Roll the material into the joints to avoid stretching. The natural thickness of the rod stock shall be approximately twice the thickness of the joint in which it is installed.
4. In raked masonry joints, apply a bondbreaker strip of polyethylene or masking tape along the bottom of the joints.
5. Where sealant is to be applied against smooth metal surfaces, wipe these surfaces clean with a suitable ketone solvent immediately prior to caulking.
6. Particular attention shall be paid to the preparation of horizontal joints in wear surfaces to be filled with sealant. Adjust joint depth to comply with sealant manufacturer's recommendations by malleting down the joint filler or filling in with rod stock as may be required. Joints in concrete paving shall be primed in accordance with manufacturer’s recommendations.
7. Perform preparation in accordance with ASTM C 1193 for solvent release sealants, C 1193 for latex base sealants, C 919 for acoustical applications, and C 1193 for elastomeric sealants.

3.3 APPLICATION

A. Priming: Prime porous joint surfaces, particularly masonry and concrete. Test the primer to make sure it causes no staining of the material on which it is applied.

B. Depth of sealant: Seal joints to a depth of approximately ½ the joint width, but never less than ¼" deep. Follow the sealant manufacturer's recommendations where possible.

C. Apply the sealant in accordance with the manufacturer's instructions.
   1. Force the sealant into joints with enough pressure to expel all air and provide a solid filling. Correct any flowing or sagging before final inspection is made.
   2. Where adjacent surfaces permit, use masking tape to obtain straight, even lines. Remove tape immediately after the joints have been sealed.
   3. Fill joints flush with adjacent surfaces except where a recessed joint is specifically detailed. Tool beads with a sled runner or similar tool to insure full contact with joint faces.
   4. For caulking horizontal joints in wear surfaces, use a gun with a narrow nozzle. Apply the flow type sealant with the nozzle riding along the bottom so that the sealant is forced up to completely fill the slot without cavities. Provide and use a portable vacuum cleaner to remove loose dirt from the joints just ahead of the caulking gun.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Tool joints concave. Sealant shall achieve a firm skin before surface coating is applied.

3.4 CLEANING/REPAIRING

A. Clean adjacent surfaces of soiling due to caulking operations. This applicator shall be responsible for and shall bear the cost of replacing any material damaged or discolored due to caulking operations.

B. Repair or replace defaced or disfigured finishes caused by work of this section.

3.5 SEALANT SCHEDULE

A. Locations specified below for sealants and caulking required under this section are general and shall not be considered as affecting the required use of sealing compounds specified under other sections of the specifications.

SEALANT TYPE		APPLICATION
1	a.	Vertical control and expansion joints in exterior and unpainted interior masonry surfaces. At joint width 1” or more, reference SECTION 07 95 00 - EXPANSION CONTROL.
	b.	Vertical joints at perimeter of window, door, and storefront elements where adjacent to stone, masonry, or concrete surfaces.
	c.	Reglets: The top groove along the surface-mounted flashing reglets.
	d.	Sealing joints in sheet metal fabrications.
	e.	Unless noted otherwise, any other exterior vertical joints.
2	a.	Interior horizontal control and expansion joints in flooring, stone, masonry and tile flooring and at junctures between these materials and other adjacent materials.
3	a.	Exterior horizontal control and expansion joints in concrete paving.
	b.	Filling of roof penetration pockets (pitch pans).
4	a.	Sealing of joints between plumbing fixtures and substrates and between plastic laminate splashes and adjacent tops and walls.
	b.	Threshold and windowsills set in full bed of sealant.
5	a.	General caulking as part of interior painting in joints subject to movement.
	b.	Sealing of joints between tilt-wall panels.
6	a.	Sealing joints between countertops and substrates in concession areas and elsewhere which may be in contact with food.
7	a.	General caulking as part of interior painting.
8	a.	Setting sill track, head track, and end studs to substrates on acoustically rated partitions. Refer to SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES for application requirements.
9	a.	Exterior horizontal control and expansion joints in concrete paving.

10 a. Sealing of joints in exterior glass-mat gypsum sheathing

11 a. Sealing of joints in butt glazing.

END OF SECTION

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SECTION 07 95 00

EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Expansion joint assemblies for floor, wall and ceiling surfaces.
2. Preformed, foam joint seals.
3. Preformed, rubber joint seals.

B. Related Sections:
1. Section 03 11 00 - Concrete Forming and Accessories: Expansion and contraction joints in exterior concrete joints.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof control joints.
3. Section 07 92 00 - Joint Sealants: Expansion and control joints.

1.2 SUBMITTALS

A. General: Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Provide joint assembly profiles, dimensions, locations in the Work, affected adjacent construction, anchorage devices, available colors and finish, and locations of splices. Provide Manufacturer's Installation Instructions. Indicate rough-in sizes.

C. Certificates:
1. Expansion Joint Covers: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.
2. Preformed Joint Seals: Tests performed by manufacturer and witnessed by a qualified testing agency for each preformed joint seal.
3. Warranties: Submit warranty information.

D. Samples:
1. Preformed Joint Seal:
a. Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.
b. Verification: For each type and color of preformed joint seal required, provide samples with joint seals in 2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint seals.
2. Expansion Joint Covers: Submit two 4" long samples, illustrating profile, dimension, color, and finish selected.

E. Templates: For cast-in or placed frames or anchors, and indicate tolerances for item placement.

F. Preformed Joint Seal Schedule: Include the following information:
1. Joint seal location and designation.
2. Joint width and movement capability.
3. Joint seal manufacturer and product name.
4. Joint seal color.

1.3 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.4 WARRANTY

A. Preformed Joint Seal:
   1. Special Warranty: Installer agrees to repair or replace preformed joint seals that do not comply with performance and other requirements specified in this Section within specified warranty period.
      a. Warranty Period: Two years from date of Substantial Completion.
   2. Special Manufacturer's Warranty: Manufacturer agrees to furnish preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
      a. Warranty Period: Five years from date of Substantial Completion.

1.5 EXTRA MATERIALS

A. Furnish under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES, AND MAINTENANCE MATERIALS.

B. **[Provide 25% overage of resilient joint filler, and special tools required for servicing components.]**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Expansion Joint Covers: Factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.
   1. Basis-of-design Products for each architectural joint system is based on products by **Construction Specialties, Inc.** Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
      Architectural Art Mfg. Inc.
      Balco Metalines, Div. of Balco, Inc.
      MM Systems Corp.

B. Preformed, Foam Joint Seals (PJS-1): Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
   1. Basis-of-Design Product: Provide **EMSEAL Joint Systems, Ltd.** Siesmic Colorseal, or subject to compliance with requirements, comparable products by one of the following:
      MM Systems Corporation.
      Nystrom, Inc.
   2. Design Criteria:
      a. Nominal Joint Width: As indicated on Drawings.
      b. Movement Capability: -50 percent/+50 percent.
   3. Joint Seal Color: As selected by Architect from full range of industry colors.
   4. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.

C. Preformed, Rubber Joint Seals (PJS-2): The expansion joint shall be a continuous low stress multi-web elastoprene compression seal that remains in compression throughout its entire movement cycle. It shall be bonded in place with polyurethane adhesive creating a watertight seal. The rubber seal design shall have a multi-cellular design or ear lugs that to lock into an aluminum frame. The seal shall be supplied in the longest continuous length possible.
   1. Basis of Design Product: Provide **MM Systems Corp. Vertical Compression Seal (VCS Series)**, or subject to compliance with requirements, comparable products by one of the following:
      MM Systems Corporation
      Nystrom, Inc.
   2. Design Criteria:
      a. Nominal Joint Width: As indicated on Drawings.

b.	Tensile Strength	1000 psi (+75/-0)	D412
c.	Ultimate Elongation	445%	D412
d.	Hardness, Shore A	65 +/- 3 pts.	D2240
e.	Tear Strength	140 pli / 24.5 kN/m @ 23°C	D624
		58 pli / 10.2 kN/m @100°C	D624

f.	Compression set		
	168 hrs.	25% @ 23°C	D395
	168 hrs.	38% @ 100°C	D395
g.	Ozone Resistance	No Cracks	D1149
h.	UV Resistance	Very Good	
i.	Brittle Point	-76°F	D746

3. Joint Seal Color: As selected by Architect from full range of industry colors.
4. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.

D. Substitutions: In accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 MATERIALS

A. Extruded Aluminum: ANSI/ASTM B 221 6063-T5 alloy for extrusions; ASTM B 308 Alloy 6061-T6, for sheet and plate.

B. Resilient Filler: Extruded vinyl exhibiting Shore 'A' hardness of 40 - 65 Durometer.

C. Threaded Fasteners: Stainless steel.

D. Primer: Manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials, or provide bituminous paint, impregnated paper or felt, or an alkali-resistant insulating coating.

E. Fire Rated Systems: Fire barrier caulk (SECTION 07 84 00 - FIRESTOPPING), fire blanket, and insulation.

F. Exterior Building Expansion Joint in Masonry Veneer: Provide Compression Seal Expansion Joint Model VCS-225 as manufactured by MM Systems

2.3 FABRICATION

A. All Metal Joint Covers: Aluminum frame construction, free of gaskets and fillers, designed to permit plus or minus 50% joint movement with full recovery, recess mounted.

B. Concealed aluminum surfaces in direct contact with masonry and concrete shall be shop coated with Manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials, or provide bituminous paint, impregnated paper or felt, or an alkali-resistant insulating coating..

C. Galvanize embedded ferrous metal anchors and fastening devices.

D. Shop assemble components and package with anchors and fittings.

E. Provide joint components in single length wherever practical. Minimize site splicing.

2.4 FINISHES

A. Floors: Mill finish.

B. Walls and Ceilings: Clear anodized.

C. Resilient Filler Exposed to View: Color as selected by Architect from standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive the materials of this section.

B. Verify that joint preparation and affected dimensions are acceptable.

C. Preformed, Foam Joint Seals: Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide anchoring devices for installation.

B. Provide templates and rough-in measurements.

C. Preformed, Foam Joint Seals
1. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
   a. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      1) Concrete.
      2) Masonry.
      3) Unglazed surfaces of ceramic tile.
   c. Remove laitance and form-release agents from concrete.
   d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:
      1) Metal.
      2) Glass.
      3) Porcelain enamel.
      4) Glazed surfaces of ceramic tile.
2. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.
3. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor components to substrate to prevent misalignment.

D. Install fire-rated systems where required.

E. Installation of Preformed, Foam Joint Seals:
1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

F. Installation of Preformed, Rubber Joint Seals:
   1. Remove and repair all unsound substrate. Joint opening sidewall interface areas must be clean and dry prior to installation.
   2. Prepare joint opening - surfaces must be sound, dry, by sandblasting free laitance, curing agents or foreign matter.
   3. Uncoil seal and allow it to relax in the sun for as long as possible before installation.
   4. Joint opening must be blown with compressed air immediately prior to seal installation.
   5. Clean and prepare sidewalls of the seal and joint opening interface per the installation guidelines.
   6. Apply a thin layer of the polyurethane lubricant adhesive to the sides of the seal (enough to fill the ribs) and to the sidewalls of the expansion joint opening.
   7. Install the seal by pushing it into the joint opening with a blunt/flat metal bar.
   8. Position seal according to dimensional guidelines.
   9. Clean excess adhesive from seal and concrete.

3.4 PROTECTION OF FINISHED WORK

A. Protect finished work under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

B. Do not permit traffic over unprotected floor joint surfaces.

C. Provide removable coating to protect finish surface.

END OF SECTION

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SECTION 08 11 00

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hollow metal doors and frames, sidelight frames, and borrowed light frames.

B. Related Sections:
1. Section 08 14 23 - Plastic-laminate-faced Wood Doors.
2. Section 08 71 00 - Door Hardware: hardware locations.
3. Section 08 80 00 - Glazing: glass for doors, sidelights, and borrowed lights.
4. Section 09 91 00 - Painting: finishing of hollow metal doors and frames.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
1. Include door sizes, construction, frame types, wall anchors, and accessories required for installation.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable local building codes for fire rated requirements of metal door/metal frame and wood door/metal frame assemblies.

B. Fire Rated Door Construction: Conform to NFPA 252 or UL 10C.

1.4 QUALITY ASSURANCE

A. Standard: Provide steel doors and frames complying with the Steel Door Institute SDI-100 and as herein specified. Hollow metal provider that is not a member of the Steel Door Institute is not approved and must submit product data and samples for review.

B. Fire-Rated Door Assemblies: Provide door and frame assemblies which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL. Metal UL classification markers shall be attached to these doors and frames.
1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

C. Conform to requirements of SDI-100.

D. Installed frame and door assembly to conform to UL 10C for fire-rated class indicated or scheduled.

E. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal doors and frames to the project site with no dents or open seams and store upright in a protected dry area. Provide packaging and wrapping to protect hollow metal items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide steel doors and frames as manufactured by one of the following:
Ceco Door Products; an ASSA ABLOY Group Co.
Curries Company; an ASSA ABLOY Group Co.
Deansteel Mfg., Inc.
Mesker Door, Inc.
Republic Builders Products Co.
Steelcraft; an Ingersoll-Rand Co.

2.2 MATERIALS

A. Sheet and Strip: ASTM A 1008, commercial quality, leveled, cold-rolled steel free of scale and other surface defects.

2.3 FABRICATION

A. Flush Steel Doors: Full flush type of welded seamless construction with no visible seams or joints on faces or vertical edges.
1. Interior door face sheets of 18 gage and exterior door face sheets of 16 gage, steel reinforced, stiffened and sound-deadened by laminating to small cell impregnated kraft honeycomb core completely filling the door or by formed steel vertical stiffeners spaced 6" o.c. and attached to face sheets by spot welds and with the spaces between stiffeners filled with inorganic blanket insulation material.
a. At exterior doors, provide insulation value of R - 8.0 for foamed-in-place polyurethane.
b. At fire rated doors, provide mineral fiberboard core as scheduled and/or as required to meet applicable codes.
2. Continuous vertical interlocking joints on lock and hinge edges with seams continuously welded, filled and dressed smooth. Bevel vertical edges.
3. Top and bottom edges closed with continuous recessed steel channels spot welded to both faces. Top edge of exterior doors sealed flush with closing channel to exclude water.
4. Fixed glass moldings welded to security side of door. Loose moldings of 20 gage steel fastened with countersunk flat head screws. Fabricate stops to receive vinyl gaskets.
5. Overlapping steel astragals for pairs of labeled doors as required by manufacturer to meet codes.
6. Louvers: Provide factory installed, inverted "V" or "Y" sightproof type fixed louvers. Louver blades shall be 18 gage and frame shall be 18 gage welded construction.

B. Steel Frames: Combination buck, frame and trim type of 16 gage steel for interior frames and 14 gage steel for exterior frames. Provide frames with face width, throat opening, backbend, and jamb depth as per dimensions shown.
1. Brake-form to profile free of warp, buckles, and fractures with corners square and sharp. Form stop integral with frame except where detailed otherwise. Dress sheared edges straight and smooth.
2. Close corner joints tight with trim faces mitered and continuously welded. Dress exposed welds flush and smooth.
3. Fabricate frames for large openings in knocked-down sections for field assembly with butt joints and internal reinforcing sleeves. Knocked-down frame assemblies shall be trial assembled in the shop.
4. Loose glazing stops shall be 16 gage steel, mitered corners, fastened with countersunk flathead screws. Fabricate stops to receive vinyl gaskets.
5. Weld 14 gage steel floor anchors inside each jamb with two holes each anchor for floor anchor bolts.
6. Furnish frames with steel spreader temporarily fastened to the feet of both jambs for rigidity during shipping and handling.
7. For each jamb in masonry construction provide 3 or more 16 gage adjustable jamb anchors of the T-strap type spaced not more than 30" apart. Furnish yoke type Underwriters anchors for labeled door openings only.
8. For each jamb in steel stud construction provide 4 or more 18 gage drywall type jamb anchors. Weld anchors inside each jamb and wire or bolt to the studs.

C. Shop Finish: After fabrication, doors and frames shall be degreased, phosphatized, and factory painted inside and out with a rust inhibitive synthetic primer. Apply mineral filler to eliminate weld scars and other blemishes.

D. Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

E. Reinforce frames wider than 48" with roll formed steel channels fitted tightly into frame head, flush with top.

F. Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

G. Attach fire-rated label to each frame and door unit.

H. Close top edge of exterior door flush with inverted steel channel closure. Seal joints watertight.

I. Fabricate frames for masonry wall coursing with 2" head member.

2.4 HARDWARE PREPARATION

A. Prepare doors and door frames for hardware. Mortising, reinforcing, drilling, and tapping shall be done at the factory for mortised hardware. Reinforcement shall be provided for surface-applied hardware, and the drilling and tapping for this hardware shall be done in the field. Provide plaster guards for hinge and strike reinforcements and cutouts on frames.

B. Reinforcement plates in doors and frames for hardware shall be 7 gage for hinges and 12 gage for all other hardware.

C. Punch for and install rubber silencers on all interior hollow metal door frames. Furnish 3 silencers for each single door and 2 silencers for each pair of doors. Set out and adjust strikes to provide clearance for the silencers. Omit silencers on exterior door frames.

2.5 CLEARANCES

A. Doors shall have pre-fit clearances of:
   1. At Head and Lock Stile: 1/8".
   2. At Hinge Stile: 1/16".
   3. At Door Sill:
      a. Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
      b. With Threshold: 1/8" from bottom of door to top of threshold.
   4. Between meeting edges of pair of doors: 1/8".

B. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80. Bevel fire-rated doors 1/8" in 2" in lock edge.

2.6 ACCESSORIES

A. Rubber Silencers: Resilient rubber.

B. Anchors: Three per jamb, typically, of type to suit supportive construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

3.2 INSTALLATION

A. Install frames in accordance with SDI-105.

B. Install doors in accordance with DHI.

C. Install fire-rated frames and place fire-rated doors in accordance with NFPA 80.

D. Coordinate with masonry and wallboard construction for anchor placement.

E. Coordinate installation of glass and glazing.

F. Install doors accurately in frames, maintaining specified clearances.

G. Setting Frames:
1. Check frames for rack, twist and out-of-square, and correct.
2. Set frames accurately to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.
3. Anchor frames securely to adjacent construction. Anchor to floor at each jamb with two bolts to prevent twist.
4. Leave spreader bars in place until frames have been permanently built into the walls.
5. Install fire-rated frames in accordance with NFPA 80.

H. Hanging Doors:
1. Fit and hang the doors to maintain specified door clearances. Metal hinge shims are acceptable to maintain clearances.
2. Doors shall be out of wind and shall operate smoothly and quietly after adjustment.
3. Place fire-rated doors with clearances as specified in NFPA 80.

3.3 TOLERANCES

A. Maximum Diagonal Distortion: 1/8" measured with straight edge, corner to corner.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid core wood doors.
2. Fire-rated wood doors.
3. Factory finishing of wood doors with transparent finish.

B. Related Sections:
1. Section 06 40 00 - Architectural Woodwork.
2. Section 08 11 00 - Hollow Metal Doors and Frames: hollow metal frames.
3. Section 08 14 00 - Plastic-laminate-faced Wood Doors.
4. Section 08 71 00 - Door Hardware: location of hardware.
5. Section 08 80 00 - Glazing: glass for doors.
6. Section 09 91 00 - Painting: finishing of wood doors with opaque finish; finishing of metal glazing frames.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Indicate sizes, construction, face veneer species, core materials, edge banding dimensions and stop profile.

C. Product Data: Indicate door core materials and construction; type and characteristics.

D. Samples:
1. Samples for Initial Selection: For factory-finished doors
2. Submit a sample, 6" by 6", of each face veneer species finish and color selected. Include factory finishes applied to actual door face materials, for each material and finish.
3. 12" x 12" sample of solid core door panel indicating construction, core, face and edge detail.
4. Submit 8-1/2" x 11" paint color samples of door glazing frame paint.

E. Certificates: Submit certification that doors comply with reference standards fabrication requirements, signed by authorized representative of door manufacturer.

1.3 QUALITY ASSURANCE

A. Standard: Comply with the requirements of "Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program" as published by Architectural Woodwork Institute.

B. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL or Warnock Hersey. Provide metal UL or Warnock Hersey classification markers attached to door.
1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

1.4 REGULATORY REQUIREMENTS

A. Fire Door and panel Construction: Conform to NFPA 252.

B. Installed Fire-Rated Door Assembly: Conform to NFPA 80 for fire-rated class as scheduled.

1.5 DELIVERY

A. Deliver doors to the project site ready for installation and to receive hardware. Each unit shall be individually plastic wrapped at the factory for protection in transit and storage.

1.6 WARRANTY

A. Special Warranty: Provide Life-of-Installation warranty on manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section. Warranty shall specifically include installation of replacement doors required during term of the warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide wood doors as manufactured by one of the following:
   Eggers Industries, Architectural Door Div.
   Marshfield-Algoma (Masonite Architectural)
   Oregon Door
   VT Industries, Inc.

2.2 MATERIALS AND FABRICATION

A. Flush Solid Core Doors: Premium Grade as defined in Section 9 of AWI Quality Standards. Adhesive for faces and crossbands shall be Type I.
   1. Core: AWI Type SLC-5 glued block.
   2. Stiles: Vertical edges at least 5/8" and bonded to core. Door stiles **Red Oak** for doors with stain grade faces, mill option for doors with paint grade faces.
   3. Rails: Top and bottom rail edges at least 1-1/8" wide and bonded to core. Species mill option.
   4. Crossbands: 1/16" selected hardwood bonded to core and to face veneer.
   5. Stain Grade Faces: I.S. "Premium Grade" plain sliced "book match" Red Oak for a transparent finish. Note: Half-round slicing will not be accepted.
   6. Stops: Provide shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.

B. Labeled Doors:
   1. "B" Label Doors (90-minute and 60-minute): AWI Type FD 1-1/2 or 1 non-combustible solid mineral core with chemically treated hardwood edge banding and fire-retardant cross banding. Faces shall be same species and quality as specified for flush doors. Pairs of "B Label" doors shall be furnished with necessary metal edge and astragal trim if required by door manufacturer to meet code requirements.
   2. "C" Label Doors: AWI Type FD 3/4 non-combustible solid mineral core with chemically treated hardwood edge banding and fire-retardant cross banding.
   3. 20 Minute Doors: AWI Type FD 1/3 solid core with a 20-Minute Fire Label. Faces shall be same species and quality as specified for flush doors.
   4. Smoke Control Door Labeling: Smoke control doors shall show the letter "S" on the fire rating label of the door. The marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.
   5. Cut-outs for vision panels in fire-rated doors shall be factory cut. No field cutting shall be permitted.
   6. Stops: Provide listed shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.

C. Fitting:
   1. Cutouts for mortise hardware shall be made to template at the factory.
   2. Top and bottom rail edges and core exposed by cutouts for hardware shall be factory sealed.
   3. Doors shall have pre-fit clearances of:
      a. At Head and Lock Stile: 1/8"
      b. At Hinge Stile: 1/16"
      c. At Door Sill:
         1) Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
         2) With Threshold: 1/8" from bottom of door to top of threshold.
      d. Between meeting edges of pair of doors: 1/8"

4. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80. Bevel fire-rated doors 1/8" in 2" in lock edge.

2.3 ADHESIVE

A. Facing Adhesive: Type I - waterproof.

2.4 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Fabricate fire-rated doors in accordance with AWI Quality Standards and to UL or Warnock-Hersey requirements. Attach fire-rating label to door.

C. Provide lock blocks at lock edge and top of door for closer and hardware reinforcement.

D. Fit door metal edge trim to edge of stiles after applying veneer facing.

E. Bond edge banding to cores.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through-bolted hardware.

G. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
   2. Dutch doors: Finish faces, all four edges, edges of cutouts, and mortises. Do not omit stains and fillers on top and bottom edges.

B. Finish doors at factory.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI Quality Standard Section 1500, Conversion Varnish Transparent
   3. Staining: Custom color stain as selected by Architect.
   4. Effect: Open grain finish.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify frame opening conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 PREPARATION

A. Condition wood doors to the average prevailing humidity in the building prior to fitting and hanging.

3.3 INSTALLATION

A. General: Installation of doors shall comply with the applicable requirements of Section 1700 Installation of Architectural Woodwork (Interior) of the AWI Quality Standards.

B. Hang doors to maintain uniform clearances. Doors shall be out of wind and shall operate smoothly and quietly after adjustment. Replace doors damaged during installation.

C. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80. Trim stiles and rails of fire-rated doors only to extent permitted by labeling agency.

D. Pilot drill screw and bolt holes.

E. Machine cut for hardware. Core for handsets and cylinders.

F. Coordinate installation of doors with installation of frames specified in SECTION 08 11 00 - HOLLOW METAL DOORS AND FRAMES and hardware specified in SECTION 08 71 00 - DOOR HARDWARE.

G. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

H. Coordinate installation of glass and glazing.

3.4 INSTALLATION TOLERANCES

A. Conform to AWI requirements for fit and clearance tolerances.

B. Maximum Diagonal Distortion (Warp): 1/8" measured with straight edge or taut string, corner to corner, over an imaginary 36" x 84" surface area.

C. Maximum Vertical Distortion (Bow): 1/8" measured with straight edge or taut string, top to bottom, over an imaginary 36" x 84" surface area.

D. Maximum Width Distortion (Cup): 1/8" measured with straight edge or taut string, edge to edge, over an imaginary 36" x 84" surface area.

3.5 ADJUSTING

A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Adjust door for smooth and balanced door movement.

C. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall, and ceiling access doors.

B. Related Sections
1. Section 03 30 00 - Cast-In-Place Concrete: Openings in concrete.
2. Section 04 20 00 - Masonry Units: Openings in masonry.
3. Section 09 21 16 - Gypsum Board Assemblies: Openings in gypsum board walls and ceilings.
4. Section 09 30 13 - Ceramic Tiling.
5. Section 09 91 00 - Painting: Field paint finish.
6. Division 22 - Plumbing components requiring access.
7. Division 23 - Mechanical components requiring access.
8. Division 26 - Electrical components requiring access.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with UL requirements for fire-rated doors.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire-rated access units.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.6 COORDINATION

A. Coordinate work under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Coordinate the work with mechanical and electrical work requiring access units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide wall and ceiling access doors as manufactured by one of the following:
J.L. Industries, Inc.
Karp Associates, Inc.
Larsen’s Mfg. Co.
Milcor Limited Partnership
Nystrom Building Products Co.

B. Provide **floor** access door as manufactured by one of the following:
Babcock-Davis Hatchways, Inc.
The Bilco Co.
Karp Associates, Inc.
Milcor Limited Partnership
Nystrom Building Products Co.

2.2 GENERAL

A. Flush metal panel access doors.

B. Size: As required for ease of access, but not less than 12" x 12".

C. Material:
1. Model M3202: Painted steel 14 gauge frame and door.
2. Model MS3202: Stainless steel 16 gauge frame and door.
3. Models DW3203 and K3200: Painted steel 16 gauge frame; 14 gauge door.
4. Model ATR3204: Painted steel 16 gauge frame; 18 gauge door.
5. Fire-Rated Model 3218: Painted and stainless steel 14 gauge frame; 20 gauge door.

D. Lock: Screwdriver operated, with metal cam.

2.3 ACCESS UNITS - WALLS

A. Non-Fire-Rated Door and Frame Unit:
1. In Cast-in-Place Concrete: Model M3202 (painted) manufactured by Milcor.
2. In Masonry: Model M3202 (painted) manufactured by Milcor.
3. In Ceramic Tile on Gypsum Board on Steel Studs: Model MS3202 (stainless steel) manufactured by Milcor.
4. In Gypsum Board on Steel Studs: Model DW3203 (painted) manufactured by Milcor.
5. In Plaster on Metal Furring: Model K3200 (painted) manufactured by Milcor.

B. Fire-Rated Door and Frame Unit: 1-1/2 hour UL B label fire rating
1. In Cast-in-Place Concrete: Model 3218 (painted) manufactured by Milcor.
2. In Masonry: Model 3218 (painted) manufactured by Milcor.
3. In Ceramic Tile on Gypsum Board on Steel Studs: Model 3218 (stainless steel) manufactured by Milcor.
4. In Gypsum Board on Steel Studs: Model 3218 (painted) manufactured by Milcor.
5. In Plaster on Metal Furring: Model 3218 manufactured by Milcor.

2.4 ACCESS UNITS - CEILINGS

A. Non-Fire-Rated Door and Frame Unit:
1. In Gypsum Board on Metal Furring: Model DW 3203 manufactured by Milcor.
2. In Plaster on Metal Furring: Model K3200 manufactured by Milcor.
3. In Metal T-Bar Ceiling: Model ATR 3204 manufactured by Milcor.

B. Fire-Rated Door and Frame Unit: 1-1/2 hour UL B label fire rating
1. In Gypsum Board on Metal Furring: Model 3218 manufactured by Milcor.
2. In Plaster on Metal Furring: Model 3218 manufactured by Milcor.

2.5 FINISHES

A. Painted Finish: One coat baked enamel primer with baked enamel finish, color as selected by Architect.

B. Stainless Steel: No. 4 finish.

C. Aluminum: Mill finish.

2.6 ACCESS UNITS - FLOORS

A. Floor Access Door:
1. Provide single-leaf door, 2'-6" x 3'-0". Type K-3 by The Bilco Company.
2. Construction: Provide door of ¼" aluminum diamond pattern plate reinforced with aluminum stiffeners as required to withstand a live load of 150 lbs. per sq. ft. Provide cast steel hinges that pivot on torsion bars that counter-balance the door for easy operation. The door shall open 90° and lock in the open position. Provide under side release handle and removable key wrench on top side. Aluminum shall be mill finished with bituminous coating to be applied to exterior of frame by manufacturer. Hardware shall be zinc-plated and chromate sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that rough openings for door and frame are correctly sized and located.

3.2 INSTALLATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that rough openings for door and frame are correctly sized and located.

END OF SECTION

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SECTION 08 33 13

COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coiling counter doors.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware: cylinders for coiling door lock and key switch.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

B. Product Data: Submit manufacturer’s product data and installation instructions for each type of coiling counter door. Include both published data and any specific data prepared for this project.

C. Shop Drawings: Submit shop drawings for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors and accessories. Include relationship with adjacent materials.

1.3 QUALITY ASSURANCE

A. Labeled Construction: Door and frame shall be manufactured in accordance with specifications and procedures for doors and frames tested and rated by Underwriter's Laboratories, Inc. Metal UL classification markers shall be attached to door and frame.

PART 2 - PRODUCTS

2.1 COILING COUNTER DOORS stainless steel

A. Manufacturer: Tornado and hurricane resistant coiling doors shall be the model SafeSpace 500-G as manufactured by McKeon Door Company. Door assembly shall be tested and certified by an accredited testing laboratory, approved for use in FEMA 361 and ICC 500-2014 safe rooms and storm shelters.

B. Face-of-Wall Mounted coiling door to detail. Product/manufacturer; one of the following:
   1. SafeSpace 500-G; McKeon Door Company
   2. DuraCoil Select; Raynor

C. Curtain: Shall be assembled of interlocking G90 galvanized steel slats. Curtain shall be formed of slat profile sections with of gauge as required to sustain the minimum required design wind pressure. Slat cross section shall not be less than 3” wide by 1-1/2” deep guides: Box type fabricated of stainless steel angles and channels.

D. Roller Shaft: Steel pipe with cast iron end plugs and containing an oil tempered, helical counterbalancing steel spring with external adjustment by means of a wheel.

E. Brackets: Heavy cast iron or steel designed to form end closure supports for the hood. Roller shaft ends shall be journaled into bracket hubs and fitted with self-lubricating bronze bearings or sealed ball bearings.

F. Hood: Not less than 20-gage stainless steel formed to fit the contour of the end brackets and reinforced with stiffening rolls at top and bottom edges.

G. Operation: Door shall be counterbalanced for ease of manual push-up operation.

H. Locking: Provide cylinder locks on bottom bar less cylinder for key operation. Cylinder locking for motor operated doors to include electrical interlock to prevent operation before door is unlocked.

I. Electric Motor Operator: Coiling door shall be provided with a compact power unit designed and built by the coiling door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency gearing running in an oil bath, shall be furnished together with a magnetic operated brake, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure.
   1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a class A or better insulation. Horsepower of motor is to be 1/2 hp minimum or of manufacturer's recommended size, which ever is greater.
   2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.
   3. Reducer: Spiral gear type, 70% efficiency minimum.
   4. Brake: Magnetically activated, integral within the operator's housing.
   5. Cycle Counter: Non-resettable operational cycle counter.
   6. Control Station: Provide surface mount push button control station marked open, close and stop.

J. Finish: The stainless curtain slats, guides, and hood shall have a No. 4 finish. All other exposed metal parts shall have a shop coat of rust inhibitive paint.

K. Bottom Bar: Shall consist of a double structural steel angle assembly formed to fit and engage the curtain assembly.

L. Guides Each guide assembly shall be fabricated of structural steel support angles and guide retaining angles of a sufficient depth to retain curtain in in the guides under the design wind pressure and impact forces specified.

M. Roller Shaft: Steel pipe with cast iron end plugs and containing an oil tempered, helical counterbalancing steel spring with external adjustment by means of a wheel.

N. Brackets: Heavy cast iron or steel designed to form end closure supports for the hood. Roller shaft ends shall be journaled into bracket hubs and fitted with self-lubricating bronze bearings or sealed ball bearings.

O. Hood: Provided with intermediate support brackets as required and fabricated of galvanized steel. Finish and color to match curtain.

P. Operation: Door shall be counterbalanced for ease of manual push-up operation.

Q. Automatic Locking Device: Shall automatically engage the bottom bar into both side guide assemblies when the door is in the fully closed position and automatically disengage when the door is raised to the open position. The internal integral automatic locking device shall not require any manual intervention for engagement or disengagement of the locking device.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coiling counter door shall be installed by skilled mechanics supervised by the manufacturer's authorized representative.

B. Erect the door, guides, and accessories in a rigid substantial manner, straight and plumb, and with horizontal lines level.

3.2 ADJUSTING

A. Adjust the door and operators and leave in good working order.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Coiling doors.

B. Related Sections:
1. Section 05 50 00 - Metal Fabrications: steel frames for coiling door openings.
2. Section 08 71 00 - Door Hardware: cylinders.
3. Section 09 91 00 - Painting: finish painting of coiling doors.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include installation details and operating procedures.

1.3 QUALITY ASSURANCE

A. Wind Load: Exterior coiling doors shall be constructed to safely resist uniform pressure (velocity pressure) of 22 psf.

B. Labeled Construction: Doors required by schedule to be labeled shall be manufactured in accordance with specifications and procedures for doors tested and rated by Underwriter's Laboratories, Inc. Metal UL classification markers shall be attached to these doors.

PART 2 - PRODUCTS

2.1 COILING DOORS

A. Provide face-of-wall mounted coiling door. Product/manufacturer; one of the following:
ESD10; Cornell/Cookson, LLC.
610 Series; Overhead Door Corp.
1. Operation: Manual push-up.
2. Curtains:
a. Interlocking slats cold roll formed of galvanized steel.
b. End of alternate slats to be fitted with malleable iron endlocks.
c. Slat design shall satisfy a windload of 20 psf.
d. Curtain to be reinforced with bottom bar consisting of two angles of galvanized steel. Install weatherseal on bottom of bars.
3. Spring Counterbalance:
a. House in steel pipe of diameter and wall thickness to restrict maximum deflection to 0.03" per foot of door width.
b. Springs to be helical torsion type.
c. Spring tension to be adjustable by means of external adjustment wheel.
4. Bracket Plates: ¼" thick min. steel formed to fit contour of end bracket.
5. Guides:
a. Structural galvanized steel angles of 3/16" min. thickness.
b. Fit guides with two flexible weathering strips (both sides).
6. Hoods:
a. Fabricated of galvanized steel sheet metal no lighter than 24 gage, laterally reinforced.
b. Provide intermediate hood supports for hoods exceeding 16'-0".
c. Fit with internal neoprene header weather baffle.
7. Locks:
a. Provide slide bolts suitable for padlocks for manually operated doors.
8. Finish:
a. Galvanized Surfaces: Apply phosphate coating for paint adherence.
b. Ungalvanized Surfaces: Shop coat of rust inhibiting metallic primer.
9. Weatherstripping: Door to be fully weatherstripped at sill, hood, and at guides.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coiling doors shall be installed by skilled mechanics supervised by the manufacturer's authorized representative.

B. Erect the doors, guides, and accessories in a rigid substantial manner, straight and plumb, and with horizontal lines level.

3.2 TESTING AND ADJUSTING

A. Upon completion of installation, put all items through at least ten operating cycles. Make required adjustments and assure that components are in optimum operating condition.

END OF SECTION

SECTION 08 39 06

TORNADO RESISTANT DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tornado Shelter Steel Doors.
2. Tornado Shelter Steel Frames.
3. Tornado Shelter Steel Doors with glass light and 90 minute rating.
4. Tornado Shelter Storm Door Hardware.

B. Related Requirements: The Contract Documents, as defined in the General Conditions and modifications thereto, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
1. Section 03 11 19 - Insulating Concrete Forming.
2. Section 04 20 00 - Masonry Units
3. Section 08 71 00 - Door Hardware
4. Section 09 90 00 - Painting

1.2 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

B. American Society for Testing and Materials (ASTM):
1. ASTM A 336 - Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled.
2. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ICC/NSSA Standard for the Design and Construction of Storm Shelters:
1. ICC 500

D. Federal Emergency Management Agency (FEMA):
1. FEMA 361/320 - Design and Construction Guidance for Community Shelters.

E. National Association of Architectural Metal Manufacturers (NAAMM):
1. NAAMM HMMA 840 - Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers.

1.3 SYSTEM DESCRIPTION

A. Tornado shelter storm doors, frames and hardware shall be provided as an integral FEMA 361/320 and ICC 500-2014 and labeled tested and certified assembly from a single supplier and installed by a single factory certified and trained installer.

B. Design Requirements:
1. Shelter entry doors and frames shall resist design wind pressures for components and cladding as described in Section 1 and Missile Impact Loads of Section 2 of “National Performance Criteria for Tornado Shelters Federal Emergency Management Agency Mitigation Directorate”, latest edition. Only single opening and paired opening doors, and frames that can resist calculated design wind pressures and laboratory tested missile impacts are acceptable.
2. All doors shall have sufficient points of connection to frame to resist design wind pressure and impact loads. All doors will be attached to the frame per the door hardware that the door and frame were tested with.

3. Protective missile resistant barrier is permitted to protect door opening. Design door to resist wind pressures. Size and number of shelter doors shall be determined in accordance with applicable fire safety and building codes.
4. Door systems, both single doors and paired openings, shall be tested and must comply with FEMA 361/320 and ICC 500-2014, and have verifiable third party conformance test results and be certified by a Nationally Recognized Independent Testing Laboratory such as Underwriter's Laboratories (UL). or Warknock Hersey (ITS).

1.4 SUBMITTALS

A. General: Reference SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES: Requirements for submittals.

B. Product Data:
1. Doors and Frames: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
2. Hardware: Manufacturer's technical product data for each item of hardware. Include information necessary to show compliance with requirements, and include instructions for installation and maintenance of operating parts and finishes.

C. Hardware Schedule: Submit hardware schedule for tornado shelter storm door hardware groups indicated in this Section.

D. Shop Drawings: Details of each opening, showing elevations and frame openings. Show provisions for hardware conforming to FEMA 361/320 and ICC 500-2014 requirements.

E. Assurance/Control Submittals:
1. Independent Tests: Complete door, frame and hardware assembly shall have been tested and certified by Underwriter's Laboratories (UL) for compliance with FEMA 361/320 and ICC 500 requirements.
2. Test Reports: Report for design wind pressure and missile impact tests in accordance with National Performance Criteria for Tornado Shelters Federal Emergency Management Agency Mitigation Directorate, latest edition.
3. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
4. FEMA 361/320 requirements.
5. ICC 500 requirements.
6. Qualification Documentation: Upon request, submit documentation of experience indicating compliance with specified qualification requirements.

F. SECTION 01 77 00 – CLOSEOUT PROCEDURES: Procedures for closeout submittals.
1. Warranty: Submit written warranty with forms complete in Owner's name and registered with manufacturer as specified in this Section.
2. Door Hardware Inspection Report: Upon request, submit inspection report by AHC certifying that door hardware has been installed in accordance with manufacturer's instructions, has been adjusted and is functioning properly
3. Installation Certification: Submit written certification of installation on form provided.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products FEMA 361/320 and ICC 500 storm doors and hardware as specified in this section with minimum five years documented experience.

B. Regulatory Requirements:
1. Tornado Shelter Door and Frame Construction: Conform to FEMA 361/320 and ICC 500.
2. Fire Door and Frame Construction: Conform to NFPA 252.
   a. Listed and labeled by UL as suitable to for the purpose specified and indicated.
   b. Listed and labeled as conforming to UL 10C.
   c. Hardware installed on fire-rated doors shall be listed and labeled as conforming to UL 10C.

C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

D. Manufacturer Installation Instructions: Contractor shall maintain current copy of tornado shelter storm door, frame and hardware manufacturer published installation instructions and FEMA 361/320 and ICC 500 requirements in Project Field Office and refer to installation instructions at all times during installation.

E. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to FEMA 361/320. Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

F. Each door and frame will have its own permanent label showing what criteria the door and frame was tested in accordance with. The label will show what independent laboratory tested this assembly. The label will show test pressures both positive and negative in pounds per square foot, and the design pressure both positive and negative,

G. Single Source for all door hardware is required. Door Hardware that is supplied under sections 08 39 06, 08 71 00, and 28 13 00 can be supplied under separate contracts but must all originate from the same manufacturer. No exceptions

1.6 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS: Transport, handle, store, and protect products.

B. Deliver doors in manufacturer's standard labeled protective packaging.

C. Accept Products on site in manufacturer's packaging. Inspect for damage. Return damaged products and replace with undamaged products.

D. Project Field Superintendent shall inspect products immediately upon delivery to project site, determine product conformance with specified requirements and reject products not complying with specifications. Project Field Superintendent shall direct that non-complying products be removed from project site immediately.

E. Store in accordance with NAAMM HMMA 840.

F. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

1.7 COORDINATION

A. Coordinate the work with door opening construction, door frames and door hardware installation.

1.8 WARRANTY

A. SECTION 01 77 00 – CLOSEOUT PROCEDURES: Procedures for closeout submittals.

B. Manufacturer Warranty: Provide one (1) year manufacturer warranty for defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Single Source for Furnishing and Installation: Each tornado shelter door, frames and hardware shall be furnished and installed by tornado shelter door, frame and hardware supplier. Installation by any other entity not permitted.

B. Doors and Frames:
   1. Steelcraft Paladin permitted at all doors, frames, and glass lites www.steelcraft.com
      a. STEELCRAFT DOORS ARE PERMITTED AT ALL STORM SHELTER LOCATIONS.
   2. Ceco Door Products permitted at all doors, frames, and glass lites that are not fire-rated www.cecodoor.com
      a. CECO DOORS PRODUCTS ARE NOT PERMITTED AT DOORS WITH FIRE RATED GLASS LITES.

C. SECTION 01 62 00 - PRODUCT OPTIONS: Product options and substitutions: Substitutions: Permitted. Only manufacturers that can provide doors, frames, glass lites and hardware as an integral FEMA 361/320 and ICC 500-2014 Tested and Certified assembly may submit for consideration as a substitute manufacturer.

2.2 TORNADO SHELTER DOORS AND FRAMES

A. Model:
1. Steelcraft: Paladin PW14 and PW: Permitted at all doors/glass lites/frames
2. Ceco Door: Storm Pro : Permitted at all doors/frames EXCEPT doors with fire rated glass lites.
3. Substitutions: See SECTION 01 62 00 - PRODUCT OPTIONS.

B. Interior Door and Frame Material: ASTM A 366 cold-rolled carbon steel sheet, 14 gage, primed, ready for field painting.

C. Pairs of Doors: Provide pairs of doors certified without use of center mullion. Removable center mullion permitted, no center mullion preferred.

D. Exterior Door and Frame Material: ASTM A 653 steel sheet, zinc-coated galvanized, 14 gage, ready for field painting.

E. Door Core: As required by FEMA 361/320 and ICC 500-2014.

F. Door Opening Size: As indicated on Door Schedule. Field measure and verify dimensions of doorframe openings.

G. Interior Fire Rated Doors: Provide units listed and labeled by UL.
1. Fire Rating: Indicated in Door Schedule.
2. Fire Testing: UL 10C for positive pressure, smoke and draft requirements.
3. Temperature Rise: Maximum 450 degrees F.

2.3 DOOR FINISH

A. Galvanizing: All components hot-dipped zinc-iron alloy coated (galvannealed) in accordance with ASTM A 653, with manufacturer’s standard coating thickness.

B. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

C. Field paint as specified in SECTION 09 90 00 - PAINTING, color selected by Architect. More than one color may be selected.

2.4 DOOR HARDWARE

A. Hardware:
1. Corbin-Russwin: www.corbin-russwin.com
2. Sargent: www.sargentlock.com
3. McKinney: www.mckinneyhinge.com
4. Norton: www.norton.com
5. Markar: www.markar.com
6. Ives: www.iveshinges.com
7. Schlage: www.schlage.com
8. LCN: www.lcncloser.com
9. Von Duprin: www.vonduprin.com

B. Product options and substitutions: Substitutions: Permitted. Only manufacturers that can provide doors, frames and hardware as an integral FEMA 361/320 and ICC 500-2014 Tested and Certified assembly may submit for consideration as a substitute manufacturer.

C. Hurricane and Tornado Resistance Compliance: Conventional exit devices and tube steel removable mullions to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

D. Multi-Point Exit Devices for Severe Storm Shelters Openings: Multi-point exit devices specifically engineered for out-swinging door applications on tornado or hurricane resistant safe shelter rooms. Extra heavy duty steel component construction with each of the latching points automatically activated when the device is locked. The multi-point exit device is approved for usage as part of a complete ICC 500 (2014) and FEMA 361/320 door, frame and hardware assembly.

E. Multi-Point Locksets, Security: Three-point locking system device engineered for in-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked.

F. Hinges, Template Hinges: Provide only template hinges which conform to ANSI A156.7.
   1. Hinges approved for usage as part of a complete ICC 500 (2014) and FEMA 361/320 door, frame and hardware assembly.

G. Door Closers; Approved for usage as part of a complete ICC 500 (201) and FEMA 361/320 door, frame and hardware assembly.

H. Cylinders and Keying: Keyed cylinders are provided by SECTION 08 71 00 - DOOR HARDWARE.

I. Tornado shelter storm door hardware shall be furnished and installed by tornado shelter storm door supplier.

2.5 HARDWARE LOCATIONS AND REINFORCEMENTS

A. Locate hardware on doors and frames in accordance with the system manufacturer's specific location.

B. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100 and FEMA 361/320 requirements.

C. Doors shall be mortised, reinforced and function holes provided at the factory in accordance with the hardware schedule and templates provided by the hardware supplier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. SECTION 01 77 00 – CLOSEOUT PROCEDURES: verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify existing conditions and door frame opening dimensions before starting work.
   2. Verify that door opening sizes and tolerances are acceptable.
   3. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 INSTALLATION

A. Install doors in metal door frames in accordance with manufacturer's published instructions and requirements of FEMA 361/320 and ICC 500-2014.

B. Install fire-rated doors in conformance with code requirements for compliance with NFPA 80 and UL 10C.

C. Coordinate installation of doors with installation of frames and hardware.

D. Install hardware in accordance with manufacturer's published instructions and requirements of FEMA 361/320 and ICC 500-2014.

E. Use templates provided by hardware item manufacturer.

3.3 FIELD QUALITY CONTROL

A. SECTION 01 45 00 - QUALITY CONTROL: Contractor Quality Control Representative shall perform contractor quality control inspections.
   1. Inspect door installation, fit and clearance. Verify required FEMA 361/320 and ICC 500-2014 label.
   2. Inspect fire door label for specified fire test ratings and requirements.
   3. Inspect door hardware installation and operation for conformance with FEMA 361/320 and ICC 500-2014 requirements.
   4. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
   5. Test and Inspection Reports shall be available to Architect upon request.

B. Hardware Supplier Field Services: At completion of hardware installation provide an Architectural Hardware Consultant (AHC) to inspect tornado shelter storm door hardware installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's installation instructions and FEMA 361/320 and ICC-2014 requirements.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

3.4 ADJUSTING CLEANING

A. Adjust for smooth and balanced door movement.

B. Adjust closers for full closure.

C. Clean doors, frames and hardware immediately after installation.

D. Clean doors and frames and polish door hardware just before Substantial Completion Inspection.

3.5 HARDWARE SCHEDULE

A. Reference SECTION 08 71 00 - DOOR HARDWARE.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum entrance and storefront systems with associated aluminum doors.

B. Related Sections:
1. Section 07 92 00 - Joint Sealants: caulking of perimeter joints.
2. Section 08 44 13 - Glazed Aluminum Curtain Walls
3. Section 08 71 00 - Door Hardware; hardware for aluminum doors.
4. Section 08 80 00 - Glazing.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Include drawings showing elevations of each entrance and storefront type, detail sections of typical composite members, and glazing details.

C. Samples: Submit for approval duplicate samples showing the limits of color range to which the entrance, storefront, and door materials will be processed. Samples shall be representative of the materials to be furnished, and the color of the installed materials shall be within the range of the approved samples.

D. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

1.3 SYSTEM DESCRIPTION AND PERFORMANCE

A. Architectural Requirements
1. Drawings are diagrammatic and do not purport to identify or solve problems of thermal or structural movement, glazing or anchorage.
2. Requirements shown by details are intended to establish basic dimensions of units, sightlines and profiles of members.
3. Provide concealed fastening wherever possible.
4. Provide continuous snap-in thermally-broken aluminum backer plate at head and jamb conditions.

B. Structural Requirements
1. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170°F. without causing detrimental effects to system or components.
2. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ANSI/ASTM E 330.
3. Limit mullion deflection to L/175, or flexure limit of glass with full recovery of glazing materials, whichever is less.
4. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
5. Storefront manufacturer shall be responsible for design and engineering of storefront system, including necessary modifications to meet specified requirements and maintaining visual design concepts.
6. Attachment considerations shall take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
7. Design anchors, fasteners and braces to be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
8. Engineer storefront and entrances to be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

C. Environmental Requirements
   1. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior. No leakage shall occur in wall when tested in accordance with ASTM E 331 at test pressure of 6.24 lbs/sq ft.
   2. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of assembly surface area, measured at a reference differential pressure across assembly of 1.57 lbs/sq ft. as measured in accordance with ANSI/ASTM E 283.
   3. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

1.4 QUALITY ASSURANCE

A. Erector Qualifications: Erection of the entrance and storefront systems and doors shall be by an experienced erector approved by the manufacturer.

B. Design Criteria:
   1. Deflection of glass framing members under design loads shall not exceed L/175 or ¾", whichever is less.
   2. Deadload deflection of horizontal glass framing members shall not exceed 0.125".
   3. Exterior Entrances and Storefront: Design windload shall be 22 psf.

C. Perform work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle system components under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Store and protect system components under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

C. Provide wrapping to protect prefinished aluminum surfaces.

1.6 COORDINATION

A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings required field measurements beyond his control.

B. Coordinate with responsible trades to establish, verify and maintain field dimensions and job conditions.

1.7 ENVIRONMENTAL CONDITIONS

A. Do not install sealants when ambient temperature is less than 40°F. during and 48-hours after installation.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure or operating components to function properly.
   2. Warranty Period: 2 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide aluminum entrances and storefronts as manufactured by one of the following:

Kawneer North America

Oldcastle Building Envelope

Tubelite, Inc

YKK AP America, Inc.

B. Aluminum Panel Spandrel: Provide Formacore by Portafab Corporation (phone 800.325.3781; website: www.portafab.com). 0.25" thick aluminum-faced panel with aluminum honeycomb core.
1. Face Sheet Thickness: 0.063".
2. Back Sheet Thickness: 0.063".
3. Finish: Clear anodized finish to match storefront, entrances and curtain wall.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B 221; AA 6063-T5 alloy, temper.

B. Sheet Aluminum: ASTM B 209; 5005-H34 alloy, temper; or other alloys and temper recommend by manufacturer appropriate for specified finish.

C. Sheet Steel: ASTM A 446; hot-dipped galvanized.

D. Steel Sections: ASTM A 36; shapes to suit mullion sections.

E. Primer and Touch-Up Primer for Galvanized Surfaces: High-zinc-dust-content paint complying with SSPC-Paint 20.

F. Fasteners: Stainless steel.

2.3 FABRICATED COMPONENTS

A. General: Form section true to details with clean, straight, sharply defined profiles, free from defects impairing strength or durability.

B. Framing:
1. Framing Types Basis of Design shall be Kawneer:
   a. Exterior: Provide the following thermally broken framing systems where shown on drawings.
      1) 2” x 6” Framing System: Kawneer Trifab™ 601T
      2) 2” x 4-1/2” Framing System: Kawneer Trifab® VG ™ 451T
   b. Interior: Provide the following framing systems where shown on drawings.
      1) 1-3/4" x 4-1/2" Framing System: Kawneer Trifab® VG 450
      2) 2” x 4-1/2” Framing System: Kawneer Trifab® VG ™ 450
2. Fabricate the aluminum entrance and storefront systems with the shapes and sections detailed.
3. Design the glass framing system to minimize loads on the glass due to building movement and incorporate provisions for thermal expansion by means of expansion joints. Where insulating glass is to be installed, design the glass framing system so that moisture does not accumulate in the glazing channel for prolonged periods.
4. Construction: Mill joints to a hairline fit. Assemble and connect members to form rigid, watertight assemblies. No exposed fastenings will be permitted. Reinforce the framing internally as required to meet the design criteria specified above.
5. Continuous Solid Closures: Fabricate required closures and covers to detail of aluminum sheet, plate, and angles. Provide solid continuous thermally-broken backer plate closures at head and all jambs.
6. Accessories: Provide glazing gaskets, flashing, and miscellaneous shims and other parts detailed or otherwise required to complete the work.

7. Provide manufacturer's standard closure plate at perimeter framing members to cover open side of framing member against surrounding construction
8. doors.

A. Doors: The aluminum doors shall be wide-stile type with 5" stiles, 5" top rail, and 9-1/2" bottom rail; square glazing stops for insulated glass units; square glazing stops.
   1. Construction: Doors shall be mortised and have reinforced welded corner construction with hairline watertight joints. Fastenings shall be concealed.
   2. Doors shall be factory fabricated by aluminum entrance and storefront manufacturer.
   3. Glazing Beads: Fixed or theft proof snap-in glazing beads on exterior or security side of doors. Interior glazing beads shall be snap-in type. All glazing beads shall have vinyl inserts and glazing gaskets.
   4. Weatherstripping: Continuous contact weatherstripping on stiles and top rails of exterior doors.

B. Hardware Preparation: Prepare and reinforce doors and door frames for hardware.
   1. Mortising, reinforcing, drilling, and tapping for mortised hardware shall be done at the factory.
   2. Wherever possible, concealed steel reinforcement for surface-applied hardware shall be installed at the factory. The drilling and tapping for surface-applied hardware shall be done in the field.

C. Reinforced Mullion: Same profile as non-reinforced frames, of extruded aluminum cladding with internal reinforcement of steel shaped structural section.

D. Flashings:
   1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oilcanning"; of proper alloy to match the finished extrusions.
   2. Subsill Flashing: Provide manufacturer’s standard high-performance, thermally-broken aluminum subsill flashing with integral weep holes. End dams shall be manufacturer’s standard fiberglass, plastic or thermally-broken aluminum end dams.

E. Extruded Aluminum:
   1. Framing System: Principal extrusions shall have a minimum wall thickness of 0.08". Moldings, trim, and glass stops shall be not less than 0.050" thick.
   2. Doors and Door Framing System: Principal extrusions shall have a minimum wall thickness of 3/16". Moldings, trim, and glass stops shall be not less than 0.050" thick.

F. Reinforcement: Concealed reinforcements for hardware in doors and frames and mullions shall be plated or galvanized steel and shall be secured in place. If Heavy Wall doors are not specified, then provide continuous reinforcement at continuous geared hinges.

G. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.

H. Rigidly fit and secure joints and corners with internal reinforcement, except that door corners will be welded. Make joints and connections flush, hairline, and weatherproof.

I. Develop drainage holes with moisture pattern to exterior.

J. Prepare components to receive anchor devices. Fabricate anchorage items.

K. Arrange fasteners, attachments, and jointing to ensure concealment from view.

L. Prepare components with internal reinforcement for door hardware.

M. Reinforce framing members for imposed loads.

2.4 HARDWARE

A. Weatherstripping: Provide Kawneer’s Polymeric Sealair Weathering System or approved equivalent, continuous at head, jamb, sill, and meeting stile.

B. Refer to SECTION 08 71 00 - DOOR HARDWARE for balance of hardware.

2.5 FINISHES

A. Finish coating to conform to AAMA 611. Finish for aluminum storefront, entrances, shall match.

B. Aluminum Finish: Exposed aluminum surfaces of entrances, storefronts, frames, doors, and all their associated parts shall be Architectural Class I AA-M10C22A41 Clear Anodic Coating, .7 mil minimum. Screw and bolt heads exposed to view shall be finished to match the exposed aluminum surfaces.

C. Aluminum Finish: Architect shall select from full range of standard manufacturers, Valspar Fluropon and PPG Duranar colors
   1. Pretreatment – The aluminum shall be thoroughly cleaned using a multi-stage cleaning process to remove organic and inorganic surface soils and residual oxides. Apply a chemical conversion coating to which organic coatings will firmly adhere.
   2. Primer – The cleaned and treated substrate shall be primed to a thickness of 0.2 – 0.3 mils using approved factory application methods.
   3. Paint – The paint system shall contain 70% PVDF (Hylar 5000® or Kynar 500®) resin and durable ceramic pigments. It shall be factory applied and oven baked for a topcoat film thickness of 1.0 mil minimum.
   4. Clear topcoat, shall be applied at 0.4 – 0.8 mils.

D. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A 123 to 2.0 oz/sq ft.

E. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive entrances and storefronts for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

B. Field check dimensions, elevations, and slopes on the connecting work affecting the entrance and storefront to assure a proper fit and weathertight installation.

C. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

3.2 INSTALLATION

A. Install wall system, doors, and glazing in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window.

B. Erecting Storefronts: Erect the members to be plumb, level, square and in proper alignment with other work, and free from sags, waves and buckles.
   1. Materials shall be accurately cut and fitted and rigidly anchored in place to resist safely all normal stresses to which the work will be subjected.
   2. Cut and machined ends and recesses shall be true, accurate and free of burrs and rough edges.
   3. Provide subsill extrusions positioned to collect water leakage through mullions and storefront. Subsill shall drain to the exterior. It shall run continuously across the opening width. The ends are sealed with end dams.
   4. Create end dams at ends of window heads, sills, at edges of storefronts, and other vertical elements to channel water to nearest weep hole away from window mullions and other items which might allow water to travel vertically.
   5. Provide clearance around the perimeter between entrance and storefront metal and the opening substrate (concrete, masonry, or stucco) for caulking.

C. Hanging Doors: Fit the doors with hardware and hang to operate smoothly, without bind or chatter.
   1. Where concealed reinforcement for hardware cannot be provided, install and use Riv-Nuts for fastening surface applied hardware.
   2. Use sex bolts and nuts for fastening closers and closer arms to aluminum doors.
   3. The use of sheet metal or self-tapping screws to mount hardware is prohibited.

D. Sealing Joints: Seal the metal-to-metal framing joints properly with butene tape and sealant in conformance with the manufacturer's standard procedure.

E. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install hardware using templates provided. Refer to SECTION 08 71 00 - DOOR HARDWARE for installation requirements.

G. Install glass and infill panels in accordance with SECTION 08 80 00 - GLAZING, using exterior dry method of glazing.

H. Install perimeter 2 part polyurethane type sealant, backing materials, and installation requirements in accordance with SECTION 07 92 00 - JOINT SEALANTS.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06" every 3' non-cumulative or 1/16" per 10', whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32".

3.4 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.5 PROTECT AND CLEAN

A. Protection of Aluminum:
1. Protect concealed aluminum surfaces that will contact masonry, concrete and steel with neoprene gaskets or a coat of bituminous paint to prevent galvanic and corrosive action.
2. If drainage of moisture from incompatible metal passes over aluminum, paint the incompatible metal with a coat of aluminum pigmented paint.
3. Protect finished aluminum surfaces from staining by gypsum and cement materials until all adjacent masonry and plaster work has been completed.

B. Cleaning: Upon completion of the work, wash down aluminum surfaces with water and soft cloths and leave in first class condition.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Flush Wood Doors
4. Section 06400 – Architectural Woodwork.
5. Section 08100 – Metal Doors and Frames.
6. Section 08200 – Wood and Plastic Doors.
7. Section 08310 – Access Doors and Panels.
8. Section 08331 – Overhead Coiling Doors.
9. Section 08332 – Overhead Coiling Grills.
10. Section 08411 – Aluminum Entrances and Storefronts.
11. Section 10605 – Wire Mesh Partitions.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

I. Provide designated product, or where more than one product or manufacturer is listed, provide equivalent product of one of other listed manufacturers.

J. Obtain each type of hardware from single manufacturer.

K. Hardware Sets within this Section are not complete with respect to thickness of doors, hand, backset, method of fastening, and other detail requirements.

L. Review Drawings and Door Schedules thoroughly and provide required hardware for openings, including openings, which may have been inadvertently omitted from Door Schedules.

M. Should opening be omitted or opening not indicated with hardware set, provide hardware of same quality, design and function as specified for similar openings.

N. Furnish hardware complete with brackets, plates, fittings, fastenings and other accessories required for installation.

O. Provide screws, nuts, bolts, through-bolts, washers, grommets and other fastening devices necessary for proper installation of hardware; match finish of hardware being attached. Non-ferrous or corrosion resistant type required where exposed to exterior atmosphere.

P. Provide concealed fastening wherever possible. Where exposed, use countersunk Phillips oval-head type screws, except flat head for hinges.

Q. Do not attach hardware to metal frames and metal doors with self-tapping or sheet metal screws.

R. Wood Screws: Full thread.

S. Machine Screws: Undercut head and full thread.

T. Hardware Items Affixed to Concrete, Masonry, or Stone: Machine screws and threaded expansion shields.

U. Provide door closers at fire-rated openings.

V. Through-bolts: Anchor overhead door closers to fire-rated wood doors with through-bolts or with screws fastened to blocking in door.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Hinges shall carry a lifetime warranty.
2. Door closers shall carry a warranty of ten (10) years.
3. Exit devices shall carry a warranty of five (5) years.
4. Heavy-duty cylindrical lever lock shall carry a warranty of five (5) years.
5. Mortise locks shall carry a warranty of five (5) years.
6. No liability is to be assumed where damage or faulty operation is due to abuse, improper usage, improper installation, or failure to exercise normal maintenance.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Permanent cylinders, cores, and keys to be installed by Owner.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

B. Five knuckle design with square corners.

C. Full mortise type, except where indicated as half mortise, half surface, or full surface in Hardware Sets.

D. Flat button tip and matching plug.

E. Non-removable pins for out-swinging exterior doors and for interior reverse bevel doors equipped with locking device; safety stud also acceptable. Non-rising pin for other doors.

F. Non-ferrous construction at locations exposed to exterior atmosphere, including doors within swimming pool area.

G. Hinges weight for doors 42 inches width, over, and for fire rated doors over 8 feet height. Heavy weight also required for high frequency doors where indicated in Hardware Sets. Standard weight at other doors.

H. Anti-friction type for doors equipped with closers.

I. Anti-friction type for doors 3 feet width and over which are not equipped with closers.

J. Plain bearing type for doors less than 3 feet width, which are not equipped with closers

K. Minimum Number Hinges:

L. Doors 5 feet or less in Height: Two (2) each.

M. Doors over 5 feet and not over 90 inches: Three (3) each.

N. Doors over 90 inches: One (1) for each additional 30 inches height or fraction thereof.

O. Dutch Doors: Four (4) each.

P. Doors over 36” wide shall have 2 pair of hinges.

Q. Minimum Size and Gauge:

R. Doors 3 feet width or less: 4-1/2x4-1/2 inches, 0.134 gauge.

S. Doors over 3 feet up to 40 inches: 5x4-1/2 inches, 0.146 gauges.

T. Doors over 40 inches: 5x4-1/2 inches, 0.190 gauge.

U. Fire rated Doors over 8 feet height: Sized as indicated above, except not less than 0.180 gauge

V. Acceptable Products:

1. McKinney T4A3786 TA2714 T2714 T4A3386 TA2314
2. Hager BB1168 BB1279 1279 BB1199 BB1191
3. Stanley FBB168 FBB179 F179 FBB199 FBB191
4. Boston Hinge BB0168 BB0179 B0179 BB0199 BB0191

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturer

a. Pemko CFM EL-CEPT
b. Securitron EL-CEPT-10

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers

a. Door Controls International (DC).
b. Ives (IV).
c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
d. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

a. Door Controls International (DC).
b. Ives (IV).
c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
d. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

a. Ives (IV).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. All lock cylinders are to be “Best” and shall be keyed at the factory where key records are maintained. “No Substitutions”

B. Owner is to provide Best Access Systems with the final keying information at least 4-6 weeks prior to the date permanent cores are needed on site. Finish Hardware supplier is to coordinate and send all information required to General Contractor for distribution to Owner. Permanent cores to be installed by Owner

C. Keys
1. Provide keys in Following Quantities or as otherwise instructed by Facilities Locksmith.
2. Grandmaster-keys (GMK): Coordinate with Campus Facilities
3. Master keys (MK - each set): Coordinate with Campus Facilities
4. Change-keys (per lock): Two (2)
5. Construction Master Keys: Ten (10)

D. All cylinders are to be furnished with keyed brass construction cores at all exterior doors, mechanical closets, elevator machine rooms and janitor closets.

E. Identification and Control:

F. Furnish visual control system; coordinate provisions with Owner. Stamp or emboss keys with identification code as instructed by Campus Facilities Maintenance Director.

G. Deliver construction master keys to Project site to General Contractor.

H. Forward permanent cylinder cores and keys directly from Best Access Systems to Owner.

I. Provide all cylinders for locksets, deadlocks, exit devices, and other control and locking devices indicated in Hardware Sets from one manufacturer.

J. Provide “Best” cylinders for locking devices specified in other sections; coordinate requirements with following Section

K. 08310 - Access Doors and Panels

L. 08331 - Overhead Coiling Doors

M. 08332 - Overhead Coiling Grilles

N. 08411 - Aluminum Entrances and Storefronts

2.6 MECHANICAL LOCKS AND LATCHING DEVICE

A. Mortise Locksets, High Security: ANSI/BHMA A156.13, Series 1000, Operational and Security Grade 1 certified mortise locksets conforming to impact requirements of ASTM F1577-95b Detention Locks for Swinging Doors

1, Backset: 2-3/4 inches.

2. Faceplate: 8 by 1-1/4 inches, adjustable from flat to bevel of 1/8 inch in 2 inches, finished to match hinge side of door.

3. Latch Bolt: Two piece anti-friction, 3/4 inch throw.

4. Strike: ANSI standard 4-7/8 inch height, 1-1/4 inch curved lip.

5. Provide strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch (3.2) beyond frame trim or the inactive leaf of a pair of doors.

6. Equip with wrought or plastic box.

7. Finish matching trim on hinge side of door.

8. Provide strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.

9. Equip with wrought or plastic box.

10. Finish to match trim.

11. Manufacturers:
    a. Corbin Russwin ML2000 Series
    b. Marks 5 Series (5RWx82)
    c. No Substitution

12. Special Functions – Security Vestibule
    a. Corbin Russwin ML2087

13. Functions:
    a. Offices – ML2055
    b. Classrooms – ML2055
    c. Mech, Storeroom, Janitor, - ML2057

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.

4. Manufacturers:
    a. Corbin Russwin Hardware (RU) - ML20900 Series.
    b. Marks #5RW96EL x 24V
    c. No Substitution.

2.8 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

B. Acceptable Products:
1. Best 83T7-S series
2. No Substitutions

C. Faceplate: 2 1/4 by 1-1/8 inches, adjustable from flat to bevel of 1/8 inch in 2 inches, finished to match trim on hinge side of door.
1. Backset: 2-3/4 inches.
2. Dead Bolt: 1 inch throw.
3. Strike: A115.3, 3-1/2 by 1-1/8 inches, no lip.
4. Equip with wrought or plastic box.
5. Finished to match trim on hinge side of door.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

B. Acceptable Manufacturers:
1. Corbin-Russwin ED5000 Series
2. Marks - M9900 series – Interior Only
3. No Substitution

C. Where security exit devices are listed, provide units capable of exceeding 1000 ft lb door pull test. Latch shall be 3/4“throw with slide action positive deadlocking. Outside trim shall be thru-bolted to chassis in two locations.
1. Corbin-Russwin ED5000S (Secure Bolt) Series at Exterior Doors
2. No Substitution

D. Gates
1. Detex V40xW ELR (Hardwire)

E. Vertical rod exit devices will not be accepted except in the following conditions:
1. Provide Less Bottom Rod applications at rated locations where door will be held open with electro magnetic holders, tied to fire control system.
2. Concealed vertical rod exit devices will not be accepted. At pairs of doors use rim exit devices with removable mullion.

F. Trim:
1. Non-rated opening Night Latch Pull:
    a. Corbin/Russwin – P957/P950
2. Interior opening, Lever Freewheeling Trim: Match lever design specified for mortise locksets:
    a. Corbin/Russwin – L955
3. Vandal Resistant Trim
    a. Corbin Russwin VT957/VT950 At all Exterior Doors

G. Standards: ANSI A156.3, Grade 1.
1. UL listed for "Accident Equipment List - Panic Hardware" at exit assemblies.
2. UL listed for "Fire Exit Hardware" at labeled assemblies.
3. Touch Bar: Modern design, recessed to provide proper clearance at door openings.
4. All touch pads to be stainless steel.
5. Provide Thru-Bolts for all exit devices.

H. Key Removable Mullions: Equip with strikes mated to exit device.
1. For use with standard exit devices at non-label assemblies:
2. Corbin-Russwin 907BKM
3. For use with standard exit devices at label assemblies.
4. Corbin-Russwin 907ABKM – 908ABKM at fire rated assemblies.

I. ELECTRIC EXIT DEVICES
1. Provide Electric Exit Devices as indicated in hardware sets. Provide latch retraction. Provide linear motor driven retraction. Power requirements shall be a minimum of 900mA provided by the security contractor’s access control panel. Security contractor shall have the responsibility for pulling this wiring for electric exit device. Electric exit device shall be capable for momentary or maintained service. Coordinate work with Security Contractor. It shall be the Security Contractor’s Responsibility for final wiring connections.
2. Acceptable Manufacturers
3. Corbin Russwin ED5000 MELR – all doors requiring exit device
4. No Substitution

2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Covers: Provide metal closer covers finished to match other hardware on the project.

8. Closer Covers: Provide PVC free closer covers with a painted finish to match other hardware on the project.

9. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolts for all door closers.

10. Hurricane and Tornado Resistance Compliance: Door closers to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers: Exterior Doors
    a. Norton 7500 SNB -Series - Exterior or Heavy Traffic Areas
    b. UNI7500 SNB – Exterior Entry
    c. No Substitution
2. Manufacturers: Interior Doors
    a. Norton 8501 SNB Series
    b. Marks 220 SNB Series
    c. Corbin Russwin – DC6000 M54 Series
    d. No Substitution.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.
b. Brass or Bronze: 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

7. Manufacturers:

a. Hager Companies (HA).
b. Ives (IV).
c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic.

C. Wall stops are preferred, Use overhead stops where wall stops cannot be used

1. Library, Cafeteria, Food Service Line Door Openings

a. Rockwood 490 Wall Mount Door Holders

2. Manufacturers:

a. Hager Companies (HA).
b. Ives (IV).
c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

D. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Architectural Builders Hardware (AH).
b. Glynn Johnson (GJ).
c. Rixson Door Controls (RF).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Hurricane and Tornado Resistance Compliance: Architectural seals to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

G. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).
4. Zero (ZE).

2.14 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Shop Installation: Install hardware on the doors prior to shipment to the jobsite. Field installed hardware will only be permitted as itemized below. Comply with all other Part 3 installation requirements.

1. Extent of shop installed hardware shall include, but is not limited to:
    a. Hanging devices.
    b. Latching devices.
    c. Operating trim.
    d. Through-door wiring cables.
    e. Door closers and overhead stops.
    f. Flush bolts, surface bolts, and coordinating accessories.
    g. Protective trim – protection plates, edge guards, trim protectors.
    h. Coat hooks, viewers, and all other door mounted accessories.

2. Hardware items which are permitted to be installed in the field include:
    a. Door stops (wall, floor, other mounting).
    b. Frame mounted closer brackets.
    c. Lock and latch strike plates.
    d. Frame wiring cables.

3. Bench test shop installed work. This includes both mechanical and electrical components. Replace defective items.

4. Ship field installed hardware items clearly labeled with the door number and attached to the door using shrink wrap. Include all templates and instructions which are required to complete the installation.

B. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

B. Existing Conditions: Door Hardware Supplier is responsible for coordination with existing conditions and hardware specified in Hardware Sets. The hardware specified in the Hardware Sets are to be considered the intent of applicable products for a complete opening solution as required by the use and functions of the opening. The Hardware Sets specified are to be considered the base bid, upon review of existing conditions and when items specified in the Hardware Sets will not comply with existing conditions, the supplier shall address the concerns and propose solutions to the contractor and architect in writing. Field verification shall be done prior to submitting shop drawings with recommendations included in shop drawings. No deviations will be acceptable, supplier shall include the cost of trip charges to the site for verification. Any unforeseen conditions will be considered for proposal request

C. All existing hardware removed from existing doors is property of Birdville ISD and is to be turned over to owner.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

3.9 SCHEDULED DOOR HARDWARE

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. RU - Corbin Russwin
5. SA - SARGENT
6. BE - dormakaba Best
7. NO - Norton
8. SU - Securitron
9. OT - OTHER

Hardware Sets

Set: 1.01

Doors: A116A, A129A

1	Continuous Hinge	CFM83SLF-HD1		PE	
1	Continuous Hinge	CFM83SLF-HD1 EL-CEPTx32D		PE	⚡
1	Removable Mullion	907BKM 7' PS		RU	
1	Exit Device (dummy trim)	ED5200S VT950ET M54	630	RU	
1	Exit Device (nightlatch)	ED5200S VT957ET M92 MELR M54	630	RU	⚡
1	Cylinder	1E-74	626	BE	
1	Cylinder	12E-72	626	BE	
2	Surface Closer	UNI7500 SN-134	689	NO	
2	Drop Plate	7788	689	NO	
2	Bracket	6190	689	NO	
2	Kit	6191	689	NO	
1	Threshold	171A		PE	
1	Weatherstrip	By Door MFG		00	
2	Sweep	18062CNB		PE	
1	ElectroLynx Harness	QC-C1500P		MK	⚡
1	ElectroLynx Harness	QC-XXXX		MK	⚡
1	Power Supply	Furnished by Security Contractor		00	
1	Card Reader	By Security Contractor		00	
2	Door Position Switch	By Security Contractor		00	

Set: 1.02

Doors: A101C

2	Continuous Hinge	CFM83SLF-HD1		PE	
1	Removable Mullion	907BKM 7' PS		RU	
1	Exit Device (dummy trim)	ED5200S VT950ET M54	630	RU	
1	Exit Device (nightlatch)	ED5200S VT957ET M54	630	RU	
1	Cylinder	1E-74	626	BE	
1	Cylinder	12E-72	626	BE	
2	Surface Closer	UNI7500 SN-134	689	NO	
2	Drop Plate	7788	689	NO	
2	Bracket	6190	689	NO	
2	Kit	6191	689	NO	
1	Threshold	171A		PE	
1	Weatherstrip	By Door MFG		00	
2	Sweep	18062CNB		PE	
2	Door Position Switch	By Security Contractor		00	

Set: 1.03

Doors: A100E, A100F, A114C, A116B, A129B

2	Continuous Hinge	CFM83SLF-HD1		PE	
2	Exit Device (exit only)	ED5000DB EO	630	RU	
2	Exit Device Trim	P950ET	630	RU	
2	Surface Closer	UNI7500 SN-134	689	NO	
2	Drop Plate	7788	689	NO	
2	Bracket	6190	689	NO	
2	Kit	6191	689	NO	

Set: 1.04

Doors: A109

1	Continuous Hinge	CFM83HD1		PE	
1	Exit Device (nightlatch)	ED5200S VT957ET M54	630	RU	
1	Cylinder	12E-72	626	BE	
1	Surface Closer	CLP7500 SN-134	689	NO	
1	Threshold	171A		PE	
1	Gasketing	332CS		PE	
1	Rain Guard	346C		PE	
1	Sweep	315CN		PE	
1	Door Position Switch	By Security Contractor		00	

Set: 1.05

Doors: A123

1	Continuous Hinge	CFM83HD1		PE	
1	Continuous Hinge	CFM83HD1 EL-CEPTx32D		PE	⚡
1	Removable Mullion	907BKM 7' PS		RU	
1	Exit Device (dummy trim)	ED5200S VT950ET M54	630	RU	
1	Exit Device (nightlatch)	ED5200S VT957ET M92 MELR M54	630	RU	⚡
1	Cylinder	1E-74	626	BE	
1	Cylinder	12E-72	626	BE	
2	Surface Closer	CLP7500 SN-134	689	NO	
1	Threshold	171A		PE	
1	Gasketing	332CS		PE	
1	Rain Guard	346C		PE	
2	Sweep	315CN		PE	
1	ElectroLynx Harness	QC-C1500P		MK	⚡
1	ElectroLynx Harness	QC-XXXX		MK	⚡
1	Power Supply	Furnished by Security Contractor		00	
1	Card Reader	By Security Contractor		00	
2	Door Position Switch	By Security Contractor		00	

Set: 1.06

Doors: A124

1	Continuous Hinge	CFM83HD1		PE	
1	Continuous Hinge	CFM83HD1 EL-CEPTx32D		PE	⚡
1	Flush Bolt	2842	US26D	RO	
1	Electrified Mortise Lock	ML20906-SEC LSA M92 LC	626	RU	⚡
1	Cylinder	1E-74	626	BE	
1	Coordinator	2672	US28	RO	
2	Surface Closer	CLP7500 SN-134	689	NO	
1	Threshold	171A		PE	
1	Gasketing	332CS		PE	
1	Rain Guard	346C		PE	
2	Sweep	315CN		PE	
1	ElectroLynx Harness	QC-C1500P		MK	⚡
1	ElectroLynx Harness	QC-XXXX		MK	⚡
1	Power Supply	Furnished by Security Contractor		00	
1	Card Reader	By Security Contractor		00	
2	Door Position Switch	By Security Contractor		00	

Set: 1.07

Doors: A100A, A101A, A114B

1	Continuous Hinge	CFM83SLF-HD1 EL-CEPTx32D		PE	⚡
1	Exit Device (nightlatch)	ED5200S VT957ET M92 MELR M54	630	RU	⚡
1	Cylinder	12E-72	626	BE	
1	Surface Closer	UNI7500 SN-134	689	NO	
1	Drop Plate	7788	689	NO	
1	Bracket	6190	689	NO	
1	Kit	6191	689	NO	
1	Threshold	171A		PE	
1	Weatherstrip	By Door MFG		00	
1	Sweep	18062CNB		PE	
1	ElectroLynx Harness	QC-C1500P		MK	⚡
1	ElectroLynx Harness	QC-XXXX		MK	⚡
1	Power Supply	Furnished by Security Contractor		00	
1	Card Reader	By Security Contractor		00	
1	Door Position Switch	By Security Contractor		00	

Set: 1.08

Doors: A100B, A100C, A100D, A101B, A114A

1	Continuous Hinge	CFM83SLF-HD1		PE
1	Exit Device (dummy trim)	ED5200S VT950ET M54	630	RU
1	Surface Closer	UNI7500 SN-134	689	NO
1	Drop Plate	7788	689	NO
1	Bracket	6190	689	NO
1	Kit	6191	689	NO
1	Threshold	171A		PE
1	Weatherstrip	By Door MFG		00
1	Sweep	18062CNB		PE
1	Door Position Switch	By Security Contractor		00

Set: 2.01

Doors: A104B, A105B, A125, A126

1	Continuous Hinge	CFM83HD1		PE
1	Deadbolt (Classroom)	8T37S	626	BE
1	Push Plate	70C-RKW	US32D	RO
1	Pull Plate	107x70C	US32D	RO
1	Door Closer	7500 SN-134 Arm As Required	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 2.02

Doors: A104C, A104D, A105C, A105D

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Deadbolt (Classroom)	8T37S	626	BE
1	Pull Plate	107x70C	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D (Head & Jambs)		PE

Set: 2.03

Doors: A113B

1	Continuous Hinge	CFM83HD1		PE
1	Push Plate	70C-RKW	US32D	RO
1	Pull Plate	107x70C	US32D	RO
1	Surface Closer	CLP7500 SN-134	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 3.01

Doors: A110

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	ML2055 LSA LC	626	RU
1	Cylinder	1E-74	626	BE
1	Surface Closer	8501 SN-134 Arm as Required	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 3.02

Doors: A122

6	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt	2942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Classroom Lock	ML2055 LSA LC	626	RU
1	Cylinder	1E-74	626	BE
1	Coordinator	2672	US28	RO
2	Surface Closer	8501 SN-134 Arm as Required	689	NO
2	Wall Stop	409	US32D	RO
2	Silencer	608		RO

Set: 4.01

Doors: A113A

1	Continuous Hinge	CFM83HD1		PE
1	Exit Device (rim, classroom)	ED5202A L955 M54	630	RU
2	Cylinder	1E-74	626	BE
1	Surface Closer	CLP7500 SN-134	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 5.01

Doors: A111

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	ML2010 LSA	626	RU
1	Surface Closer	CLP8501 SN-134	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
3	Silencer	608		RO

Set: 6.04

Doors: A118A, A202

1	Hardware by Door Mfg	-		OT

Set: 7.01

Doors: A112, A120

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	ML2030 LSA M19V	626	RU
1	Surface Closer	8501 SN-134 Arm as Required	689	NO
1	Kick Plate	K1050 10" x 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 8.01

Doors: A103A

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	ML2057 LSA LC	626	RU
1	Cylinder	1E-74	626	BE
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 8.02

Doors: A118B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	ML2057 LSA LC	626	RU
1	Cylinder	1E-74	626	BE
1	Surface Closer	8501 SN-134 Arm as Required	689	NO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D (Head & Jambs)		PE

Set: 8.03

Doors: A121

2	Continuous Hinge	CFM83HD1		PE
1	Flush Bolt	2942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom Lock	ML2057 LSA LC	626	RU
1	Cylinder	1E-74	626	BE
1	Coordinator	2672	US28	RO
2	Surface Closer	8501 SN-134 Arm as Required	689	NO
2	Wall Stop	409	US32D	RO
1	Gasketing	S773D (Head & Jambs)		PE

Set: 8.04

Doors: A103B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK	
1	Storeroom Lock	ML2057 LSA LC	626	RU	
1	Cylinder	1E-74	626	BE	
1	Surface Closer	CLP8501 SN-134	689	NO	
1	Wall Stop	409	US32D	RO	
3	Silencer	608		RO	

Set: 9.01

Doors: A117

2	Continuous Hinge	CFM83SLF-HD1		PE	
1	Removable Mullion	907BKM 7' PS		RU	
2	Exit Device (classroom)	ED5200 L955ET	626C	RU	
2	Cylinder	1E-74	626	BE	
2	Surface Closer	UNI7500 SN-134	689	NO	
2	Drop Plate	7788	689	NO	
2	Bracket	6190	689	NO	
2	Kit	6191	689	NO	

Set: 10.01

Doors: A119

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK	
1	Electrified Mortise Lock	ML20906-SEC LSA M92 LC	626	RU	⚡
1	Cylinder	1E-74	626	BE	
1	Door Closer	7500 SN-134 Arm As Required	689	NO	
1	Wall Stop	409	US32D	RO	
1	ElectroLynx Harness	QC-C1500P		MK	⚡
1	ElectroLynx Harness	QC-XXXX		MK	⚡
1	Electric Power Transfer	CEPT-10		SU	⚡
1	Power Supply	Furnished by Security Contractor		00	
1	Card Reader	By Security Contractor		00	
1	Door Position Switch	By Security Contractor		00	

Set: 11.01

Doors: A201

2	Continuous Hinge	CFM83HD1		PE
1	Flush Bolt	2842	US26D	RO
1	Classroom Lock	ML2055 LSA LC	626	RU
1	Cylinder	1E-74	626	BE
2	Surface Closer	UNI7500 SN-134	689	NO
1	Threashold	See Sill Detail	-	PE
1	Gasketing	332CS		PE
1	Rain Guard	346C		PE
2	Sweep	315CN		PE
1	Door Position Switch	By Security Contractor		00

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass and glazing accessories.

B. Related Sections:
1. Section 06 40 00 - Architectural Woodwork; display case glass, track, and hardware.
2. Section 07 92 00 - Joint Sealants
3. Section 08 11 00 - Hollow Metal Doors and Frames.
4. Section 08 14 00 - Wood Doors.
5. Section 08 14 23 - Plastic-laminate-faced Wood Doors.
6. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.

1.2 PERFORMANCE REQUIREMENTS

A. Glass and glazing materials of this section shall provide continuity of building enclosure vapor and air barrier
1. In conjunction with materials described in SECTION 07 92 00 - JOINT SEALANTS.
2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

B. Design and size glass to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ASTM E 330.

C. Limit glass deflection to l/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.3 SUBMITTALS

A. Submit product data and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Provide data on glazing sealant. Identify colors available.

D. Samples:
1. Submit 2 samples of each type of glass (except clear glass), 12" x 12" in size, illustrating glass unit, coloration, design.
2. Submit 4" long bead of glazing sealant in color selected.

1.4 QUALITY ASSURANCE

A. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual."

B. Source Quality Control: Glass shall be identified by the manufacturer's labels of grade and quality. Temporary labels shall not be removed until final cleaning. Permanent labels on tempered glass shall not be removed.

C. Safety Glazing Standard: Where safety glass is indicated or required, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for Category II materials.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glass and glazing materials during delivery, storage, and handling as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, or temperature changes, and other causes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design products are Vitro Architectural Glass (PPG): Provide glass as manufactured by one of the following:
AGC Glass North America
Guardian Industries Corp.
Technical Glass Products
Oldcastle Building Envelope
Pilkington North America, Inc. (NSG Group)
Vitro Architectural Glass (formerly PPG Glass)

2.2 GLASS

A. (CT4) Tempered Glass, Clear: ASTM C 1048, Type I, Class 1 (Clear), Quality q3 (Glazing select). Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thickness.

B. (FR) Fire- and Impact Safety-Rated Ceramic Laminated Glazing (20-180 min.): Clear, ceramic flat glass; laminated 5/163/8 inch nominal thickness; complying with testing requirements in ANSI Z97.1 and 16CFR1201 for Category I and II materials and is hose stream tested. Subject to compliance with requirements, provide one of the following:
Technical Glass Products.; FireLite Plus (800.426.0279)
Schott North America, Inc.; Pyran Platinum L (SAFTIFIRST, 888.653.3333)

2.3 BULLET RESISTANT GLASS

A. Provide bullet resistant glass for new and existing aluminum framed doors and windows as indicated. Include glazing anchor system for existing framing to improve safety and security performance meeting National Institute of Justice (NIJ) Level IIA, or UL 752 Level 2 requirements.

B. Bullet Resistant Glass (BR-2): Level IIA - Insulated Glass-clad Polycarbonate, meeting both part 1 and part 2 (no spall and no penetration).
1. Basis of Design: ESG_BR-1131, as manufactured by The Enpro Group
a. Laminated glass (outboard lite), hermetically sealed air space, GCP Plus (inboard lite)
1) Nominal total thickness: 1-1/8 inches.
2) Weight: Approximately 9.86 lbs/sf
3) U-value: 0.50
4) Shading Coefficient: 0.74
5) Visible Light Transmittance: 0.73

2.4 GLAZING MATERIALS

A. Glazing Compound: Comply with ASTM C 1311 or FS TT-S-00230, one-part, non-sag acrylic polymeric sealant. Product/manufacturer; one of the following:
Acryl-R Acrylic Sealant; Schnee-Moorehead, Inc.
Mono 555; Tremco

B. Channel Glazing Strips; Hollow Metal Doors and Frames: Provide black vinyl channel glazing strips, Glazing Vinyl for 990 Sliders Part #6062-01 as manufactured by Kawneer.

C. Accessories: Setting blocks, tape, vinyl gaskets and spacer strips as required for a complete installation.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive glass for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Setting Glass: Glazing shall be done at the site by skilled glaziers in conformance with the general conditions governing glazing in the GANA Glazing Manual.
1. Glazing of aluminum windows and storefront shall be done in conformance with the methods recommended by the manufacturer of the aluminum items. Beads or stops furnished with the items to be glazed shall be used to secure the glass in place.
2. For interior hollow metal door and frame glazing, install channel glazing strips and place glass within glazing strips. Install the removable stop and position the channel glazing strip to seal completely the void around the glass.
3. Verify glass sizes for required edge clearances by measuring the openings. Cut each piece accurately and fit to its particular position. Center glass in the opening vertically and horizontally. Use edge blocks in vertical jambs to prevent lateral "walking" of the glass.
4. Glass shall have clean cut edges. Do not seam, nip, stone or strike edges, or scarf corners, and do not install glass with flared edges at the bottom. Do not bump, drag, or rest the edge of a glass light against metal or other hard objects.
5. Set tempered glass with tong marks completely concealed or in as inconspicuous a location as possible.

B. Application of Ballistic Resistant Film to Existing Glass and frame without Dismantlement: Apply security film past the edge of the visible glass and extend onto the frame.
1. Apply to all glass 7 feet and below.
2. Apply 15mil security film on secured side of glass, anchored to frame with Dow 995 structural sealant with BondKap over sealant. Must achieve minimum 1/2-inch contact between Dow 995 bead to frame and minimum 1/2-inch contact between Dow 995 bead to window film.
3. Doors with Glass - 15mil security film applied glass edge-to-glass edge on secure side of glass and Dow 995 applied under caps/stops to adhere film-to-frame-to-cap/stop. Splicing: Splices and seams in security film are permitted only when a sheet of glass has a dimension exceeding 58 inches in both directions. Apply seams with a minimum overlap of 1/4 inch unless submitted test reports indicate impact performance is not diminished when seam is applied with a different overlap or a gap.

3.3 CLEANING

A. Upon completion of the building, clean glass on both sides and remove labels, paint spots, putty and other defacement. Replace damaged glass with new.

END OF SECTION

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SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal stud wall framing.
2. Furred wall framing.
3. Metal channel ceiling framing.
4. Gypsum board partitions, ceilings, and furrings
5. Finishing of panel joints.
6. Exterior sheathing.

B. Related Sections:
1. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
2. Section 05 40 00 - Cold-Formed Metal Framing: exterior wall studs.
3. Section 07 21 00 - Building Insulation: acoustical and thermal insulation.
4. Section 07 84 00 - Firestopping.
5. Section 09 30 13 - Ceramic Tiling: backer board at shower areas.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES. Submit materials list of items proposed to be provided, manufacturer's data indicating compliance with specified requirements, and manufacturer's recommended installation procedures.

B. Submit diagrams of proposed control joint and expansion joint layout prior to starting work.

1.3 QUALITY ASSURANCE

A. Tolerances for Drywall: Do not exceed a variation of 1/8" in 10'-0" and 1/16" in 5'-0" from plumb, level, and flat (all directions) and do not exceed 1/16" offset of planes at joints between panels. Shim panels as necessary to comply with tolerances.

B. Perform Work in accordance with ASTM C 840, GA-216, GA-223 and GA-600.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: In cold weather, maintain the temperature of the building reasonably constant at no less than 55° F. during gypsum panel application and joint finishing. Provide adequate ventilation to carry off excess moisture.

1.5 DELIVERY, STORAGE, HANDLING

A. Deliver, store, handle, and protect products in conformance with manufacturer's instructions and in accordance with Section 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store inside building, on sleepers, and out of water.

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gypsum Board (20A): ASTM C 1396. Provide Type X fire-rated; 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Product/manufacturer; one of the following:
   CertainTeed Type X; CertainTeed Gypsum
   ToughRock Fireguard X Gypsum Board: G-P Gypsum Corp.
   Fire-Shield Gypsum Wallboard; National Gypsum Co.
   Sheetrock Brand Firecode Core Gypsum Panel; USG Corporation

B. Water- and Mold-Resistant Gypsum Board: ASTM C 1396. Provide Type X, water and mold resistant; 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Gypsum board to be covered with ceramic tile in toilets, EWC alcoves, and other wet areas (except showers) shall be specially processed moisture-resistant gypsum board. Product/manufacturer; one of the following:
   M2Tech Type X; CertainTeed Gypsum
   ToughRock Fireguard X Mold-Guard Gypsum Board: G-P Gypsum Corp.
   Gold Bond XP Fire-Shield Gypsum Wallboard; National Gypsum Co.
   Sheetrock Brand Mold Tough Firecode Core Gypsum Panel; USG Corporation

C. Abuse-Resistant Gypsum Board (20B): ASTM C 1396, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels. Provide Type X fire-rated, 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Product/manufacturer; one of the following:
   AirRenew Extreme Abuse Resistant Gypsum Board; CertainTeed Gypsum
   ToughRock Abuse-Resistant Gypsum Board; G-P Gypsum Corp.
   Gold bond Hi-Abuse Wallboard; National Gypsum Co.
   Sheetrock Brand Abuse-Resistant Gypsum Panels; USG Corporation

D. Gypsum Tile Backer Board: Refer to Section 09 30 13 - CERAMIC TILING for gypsum tile backer board to be used as a substrate for ceramic wall tile at shower areas.

E. Sheathing Board System: Reference SECTION 06 16 56 - AIR- AND WATER-RESISTIVE SHEATHING BOARD SYSTEM

F. Studs: ASTM C 645. Non-loadbearing channel type roll-formed from minimum 25 gauge electro- or hot-dipped galvanized steel.
   1. Provide 20 gauge studs at interior ceramic tile partitions.
   2. Provide 18 gauge studs, per SECTION 05 40 00 - COLD-FORMED METAL FRAMING, at all X-bracing.

G. Slotted Top Track: Sliptrack Systems, SLP-TRK®, (phone 888.475.7875 web site: www.sliptrack.com).
   1. 25 ga thick, to ASTM A653/A653M, Grade 33 with a minimum yield point of 33,000 psi, electro- or hot-dipped galvanized steel.
   2. 2-1/2" down-standing legs with 1/4" wide by 1-1/2" high slots spaced at 1" on center.
   3. Track width shall match stud size by manufacturer's standard length.
   4. Fasteners: ASTM C 1002, self-drilling, self-tapping screws.

H. Furring, Framing and Accessories: Provide in conformance with ASTM C 645, GA-216, and GA-600 and as follows:
   1. Cold Rolled Channels: 3/4", 1-1/2" and 2" x 9/16", 16 gauge, steel channels prime painted.
   2. Furring Channels: ASTM 645, 7/8" deep x 1-1/4" face, roll-formed from 25 gauge electro-galvanized steel and furnished with galvanized wire clips.
   3. Resilient Furring: 1/2" deep x 2" x 1-1/4" screw flange, 25 gage, galvanized with one leg attached only, Style RC-1 PRO™ as manufactured by ClarkDietrich Building Systems.

I. Fasteners: ASTM C 514 for nails and C 1002 for screws as follows:
   1. Inserts, clips, bolts, nails or other screws as recommended by wallboard manufacturer, of type and size to suit application and to rigidly secure materials in place.
   2. Self-drilling, self-tapping bugle head screws for use with power drive tool.
   3. Screws: Drywall Screws, Type S Bugle Head.
   4. Metal framing to structure: Power driven screw fasteners to withstand 190 lb. single shear resistance and 200 lb. bearing force when drive through structural head or base and without exceeding allowable design stress in runner, fastener, or structural support.
   5. Metal to metal: 3/8", Type S or S-12, pan head screws.

6. Gypsum board to sheet metal application: Type S Bugle Head screws.
7. Gypsum board to gypsum board application: Type G screws.

J. Adhesive: Utilize adhesive meeting requirements of GA-216 over metal framing.

K. Accessories:
1. Runners: ASTM C 645, channel type sections roll-formed from electro-galvanized steel with unhemmed edges. Same gauge as studs with which used.
2. Hangers: No. 8 gauge annealed, galvanized wire.
3. Tie Wire: No. 16 gauge annealed, galvanized wire.
4. Trim: Galvanized steel corner reinforcements, edge trim angles and casings; USG No. 200 series.
5. Reinforcing Tape: 2-3/16" minimum width, cross laminated, spark perforated fiber tape.
6. Joint Compound: Quick-drying, polyindurate-type, pre-fill material.
7. Joint Topping: Vinyl base all-purpose finishing material.
8. Acoustical Sealant: A one-part acrylic base sealant designed for use with drywall construction.
9. Edge Sealant: USG Sheetrock Brand W/R Sealant for use in high-moisture room areas.
10. Control Joints: Roll-formed zinc control joints with 1/4" slot (USG #093).

L. Special Trim: Softforms reveals by Pitcon Softforms as detailed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Workmanship: The completed gypsum wallboard surfaces shall be smooth, level or plumb, and acceptable to the finish material applicators. All joint treatment on exposed wallboard shall be invisible after painting.

B. Ceiling Furring:
1. Install in accordance with ASTM C 754, GA-216, GA-223 and GA-600 and manufacturer's instructions.
2. Space ceiling hangers 48" o.c. along runner channels and within 6" of ends of channel runs. Wrap or saddle-tie hangers around the runner channels to prevent twisting.
a. Under steel construction, wrap hangers around or clip or bolt hangers to a structural steel member (not steel deck).
b. Under bar joists suspend hangers from top chord or from bottom chord at panel points only.
c. Under ductwork, employ trapeze system of hangers to support ceiling. Do not suspend hangers from ducts, piping or conduit.
3. Erect runner channels at 48" o.c. maximum and locate a channel within 4" of each parallel wall. Level channels with hangers taut and do not make kinks or bends in the hangers as a means of leveling. At channel splices, overlap ends 12" with flanges interlocked; secure each end with tie wire.
4. Erect furring channels at 16" o.c. for 1/2" thick gypsum or 24" o.c. for 5/8" thick gypsum board and at right angles to runner channels or main support members; secure with clips or saddle-tie to supports with tie wire. Make end splices by nesting channels 8" and wire tying each end.
5. At light troffers or other openings that interrupt the runner or furring channels, install additional reinforcing to restore lateral stability of the grillage.
6. No part of the suspended grillage (main runners and cross furring) shall be permitted to come in contact with abutting masonry walls and partitions.

C. Wall Furring: For gypsum wallboard over masonry, space furring channels vertically at 24" o.c. maximum and attach with power driven anchors through alternate wing flanges (staggered), spaced 24" o.c. Make end splices with 8" nested laps anchored to wall with two fasteners in each wing. Where necessary, install furring with adjustable furring brackets and 1/2" x 3/4" steel channels to which the furring channels shall be clipped or tied.

D. Partitions:
1. Follow recommendations of U.S. Gypsum Co., "Gypsum Construction Handbook".
2. Install studding in accordance with ASTM C 754, GA-216, GA-223 and GA-600.
3. Erect partitions with studs aligned to be plumb and true. Anchor studs top and bottom with runners, shoes and clips.
4. Attach floor runners to concrete slabs using shielded screws or power driven fasteners. Locate fasteners at corners and at runner ends and spaced not to exceed 24" o.c.

5. Under drywall ceilings, attach metal runner to ceiling and position studs to engage the ceiling runner. Elsewhere, extend studs above the ceiling and brace securely to the floor above or roof structure above with a continuous top runner and channel braces unless specifically detailed otherwise. Where studs extend more than 24" above finished ceiling line, provide either 5/8" gypsum board on both sides of studs or horizontal bracing at 16" o.c. attached with mechanical fasteners to both flanges of studs.
6. For fire rated partitions and where specifically detailed or noted, extend studs full height to the floor or roof structure above.
7. Space studs as shown and noted but not more than 16" o.c. Locate studs not more than 2" from abutting partitions and partition corners. Anchor studs to runner flanges with positive screw engagement where located at corners and at door frame jambs.
8. At door frame jambs of doorways up to 4'-0" wide, double the studs or reinforce with 20 gauge steel studs. At jambs of doorways over 4'-0" wide, reinforce with two 20 gauge steel studs placed back to back. Fasten reinforcing studs to the anchor clips on each door frame with bolts or screws. Place horizontally over each frame a cut-to-length section of runner track; attach with screws to the adjacent vertical studs.
9. In chase wall construction, set studs opposite each other with the flanges in the same direction and cross brace between the rows of studs with three 12" high pieces of gypsum board or three pieces of metal stud attached to each pair of studs at the quarter points with drive screws.
10. Double the studs at vertical control joints in partitions.
11. Brace partitions to top chord of the structure above with 20 ga. diagonal braces at 4'-0" o.c. minimum. Where floor to structure height exceeds 16'-0", in addition to extending and fastening studs to structure, add 20 ga. stud diagonal braces at 4'-0" o.c. minimum.

E. Slotted Top Track: Install slotted track in strict accordance with manufacturer's written instructions and recommendations.
   1. Secure studs to slotted top track with #8 wafer-head screws.
   2. Maintain minimum deflection gap of 0.65 inch between top of stud and top of slotted track.
   3. Limit vertical movement to 1 inch, plus or minus 1/2 inch.

F. Sealant Application: Caulk those gypsum drywall partitions which have sound attenuation blankets, serving as sound barriers.
   1. Apply sealant in two continuous beads underneath runners at the floor and ceiling and where runners are used at partition intersections with dissimilar wall construction.
   2. Fill with sealant the grooves around the edges of wallboard at the floor, ceiling, and intersections with dissimilar walls.
   3. Caulk fully the openings around all cut-outs at electrical boxes, heating ducts and the like.

G. Exterior Walls: Erect the exterior walls as detailed.
   1. Glass Mat Gypsum Sheathing:
      a. Install exterior sheathing horizontally over the outside face of metal studs (SECTION 05 40 00 - COLD-FORMED METAL FRAMING). Screw-attach sheathing to exterior of each stud with screws spaced 3/8" from ends and edges and approximately 8" o.c. Make all end joints at bearings.
      b. Seal joints with joint tape and joint sealant.
         1) Apply glass mesh joint tape to all joints, overlapping at intersections by the width of the tape.
         2) Apply approximately 3/8" bead of caulk along the joint.
         3) Embed the caulk into the entire surface of the tape with a trowel.
         4) Use backer rod for openings larger than 1/8".
         5) Apply enough caulk to each exposed fastener to cover completely when troweled smooth.
         6) Approximately rate of usage is 48 sq. ft. per 10.5 oz.

H. Wallboard Application:
   1. Apply gypsum wallboard first to the ceilings and then to the partitions. Use maximum practical lengths to minimize end joints. Fit ends and edges closely but not forced together.
   2. For single-layer ceiling application, apply wallboard with the long dimension either parallel or at right angles to the framing members. All abutting ends and edges shall occur over framing members, except in horizontal application. Stagger end joints in adjacent rows.
   3. For single-layer wall application with a ceiling height of 8'-2" or less, use either the horizontal or the vertical application method. With a ceiling height over 8'-2" and for fire-rated partitions, use only the vertical application method without any exposed horizontal joints. Stagger the vertical joints on opposite sides of a partition. Extend wallboard full height to the floor or roof structure above where so detailed.

4. Fasten wallboard firmly to studs and furring channels with power-driven drywall screws. Gypsum board shall extend to within 1/4" of floor line. Drive screw heads close without cutting the surface paper or fracturing the core. Maximum screw spacing shall be 12" o.c. for ceilings and 16" o.c. for partitions. For fire-rated partitions, maximum spacing shall be 12" o.c. Do not drive screws closer than 3/8" from any edge.
5. For two-layer wall application, apply the base layer of wallboard vertically; attach with screws spaced 16" o.c. Apply the face layer vertically with joints offset 24" from base layer joints; attach with adhesive and 1-5/8" screws spaced 16" o.c.
6. Wallboard joints in single layer or in face layer of two layer applications shall not occur within 12" of the corners of door frame, window frames, and openings larger than 12" x 12", unless control joints are installed at the corners.
7. Accurately cut and fit abutting ends, edges and holes for pipes and electrical fixtures. Support the edges of gypsum wallboard at cutouts and openings.
8. Reinforce exposed external corners with metal corner reinforcement.
9. Where wallboard surfaces abut dissimilar intersecting surfaces such as metal and masonry, trim the meeting edge with a metal trim angle held approximately 1/4" away from the intersecting surface. Caulk the joint full with sealant; tool smooth.
10. After application, check all gypsum wallboard for loose fasteners; drive tight any found loose.

I. Control Joints:
   1. Isolate gypsum wallboard surfaces with control joints where specifically detailed and where the following conditions exist:
      a. Partition or furring run exceeds 30 feet without a corner or a ceiling-height door frame.
      b. Ceiling dimensions exceed 50 feet in either direction.
      c. Construction changes within the plane of the partition.
      d. Each side of column furring within a partition run.
      e. Above each door jamb from head to top of partition.
      f. At each side of furr downs.
   2. Locate control joints in partitions at less-than-ceiling-height door frames with control joints extending to the ceiling from both top corners.
   3. Make joints with roll-formed zinc control joints (USG #093) with 1/4" slot.
      a. Do not install roll-formed joint behind ceramic tile. Provide a 1/4" wide gap in the substrate only.
      b. At acoustical partitions, seal behind the joints with acoustical sealant.
   4. Back-block ceiling control joints with face panel strips laid over the joints.
   5. At acoustical partitions, seal behind partition control joints with batt acoustical insulation stuffed between the doubled studs.

J. Edge Sealing: On wallboard partitions to be covered with ceramic tile, treat cut edges, holes, corner joints, and intermediate joints with edge sealant before installation of wallboard panels. Treat all fastener heads with edge sealant after installation. Caulking of openings through ceramic tile is specified in SECTION 09 30 13 - CERAMIC TILING.

K. Joint Treatment:
   1. Finish the joints in exposed wallboard, wallboard which is to be covered with vinyl wall covering and carpet wall covering, and wallboard in sound partitions to deck. Joints in wall board to be covered with ceramic tile shall be filled but may be left unfinished.
   2. Fill the V-grooves between boards with quick drying joint compound. Wipe joints clean of excess compound and allow to harden.
   3. Apply a thin layer of joint topping to joints. Immediately embed tape reinforcement over joints, follow with a skim coat of compound.
   4. Apply joint topping over the tape to fill flush with the board surface.
   5. Apply joint topping over the fill coat and feather out smoothly beyond fill coat edge. Sand between coats as necessary to provide a smooth surface ready for painting.
   6. Fill screw head depressions flush with three coats of compound.
   7. Finish metal corner reinforcements and edge and control joint trim with two or three coats of joint compound, using edge of trim as a screed to secure a smooth, flat finish.

L. Special Finishes for Gypsum Board Surfaces:
   1. Areas Designated with Dry Erase Coating: Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 5 Finish per ASTM C840 and GA-214-Recommended Levels of Gypsum Board Finish. Recess nails and screws. Repair irregular tape joints, sand and remove dust. Ensure gypsum wallboard surfaces scheduled to receive dry-erase coatings are properly primed with recommended primer.

2. Areas Designated with Dry Erase Wall Covering: Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, per ASTM C840 and GA-214-Recommended Levels of Gypsum Board Finish.
3. Permanent lighting should be installed and operational for inspection of these areas prior to application of wall finish.

3.2 TOLERANCES

A. Maximum variation from true flatness: 1/8" in 10 feet in any direction.

END OF SECTION

SECTION 09 30 13

CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Ceramic tile and marble thresholds.

B. Related Sections:
1. Section 07 92 00 - Joint Sealants.
2. Section 09 21 16 - Gypsum Board Assemblies.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Submit tile samples of the same size scheduled for each particular type of tile required.

C. Certificate: Furnish one master grade certificate on ceramic tile executed prior to delivery of the tile to the site.

1.3 QUALITY ASSURANCE

A. Standard: Ceramic tile shall be Standard Grade complying with the requirements of ANSI A 137.1. Deliver tile to the project site in grade sealed containers.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained.

B. Do not install adhesives in a closed, unventilated environment.

C. Maintain 50°F. during installation of mortar materials.

1.5 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to the project site one box for each type, color, pattern, and size of ceramic tile installed. Furnish maintenance materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identifying labels.

PART 2 - PRODUCTS

2.1 TILE

A. Ceramic tile and trim as manufactured by American Olean, Dal-Tile Corp., Interceramic, and Crossville Ceramics shall set all standards in the areas of trim shapes availability, tile size, color, pattern, and texture.

B. Provide factory made fitters and trim shapes required for a finished installation. Keep job-cut fitters and trim shapes to a minimum. Provide bullnose tile at horizontal and vertical tile edges.

C. Ceramic Tile:
1. Floor Tile (3M): 12" x 24", unglazed, unpolished porcelain tile. Colors shall be as selected by Architect from full range of colors from Dal-Tile's "Pietre Vecchie" and Crossville's "Empire Series".

D. Marble Thresholds: Group A domestic white marble with honed finish.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, domestic manufacture.

B. Dry-Set Mortar: ANSI A 118.1, factory sanded mortar mix.

C. Adhesive: ANSI A 136.1, Type I, prepared organic adhesive.

D. Grout:
   1. Floor:
      a. ANSI A118.7, latex modified dry-set Portland cement or commercial waterproof Portland cement grout. Color(s) shall be selected by Architect from Custom Building Products, Laticrete, Mapei or approved equivalent.
      b. ANSI A118.3; epoxy grout at kitchen, associated areas and restrooms: Color(s) as selected by Architect.
   2. Walls: Modified acrylic, premixed Mastic Grout or dry-set grout complying with ANSI A118.7, color(s) as selected by Architect from Custom Building Products, Laticrete, Mapei or approved equal. If Contractor elects to provide dry-set grout, the installation shall be damp cured.

E. Lime: ASTM C 207, Type S, hydrated lime.

F. Sand: ASTM C 144, clean, masonry sand.

G. Water: Clean and potable.

H. Reinforcement: 1-1/2" x 17 gage galvanized woven steel wire fabric or 2 x 2 x 16/16 gage galvanized welded steel wire fabric.

2.3 SETTING BED MORTAR

A. Mix one part Portland cement and 4 parts damp sand, by volume. Hydrated lime may be added for plasticity in an amount not to exceed 1/10 part by volume.

2.4 SHOWER PAN

A. Shower Pan: Composeal Gold 40-mil Waterproof Membrane as manufactured by Compotite Corp.; Chloraloy 240 Shower Pan Liner as manufactured by Noble Co.; or approved equal. Provide a 40-mil thickness crack isolation waterproofing sheet membrane.

2.5 BACKER BOARD

A. Tile Backer Board: ASTM C 1178, for installation under ceramic tile on steel studs at shower locations. Provide one of the following Products/Manufacturers:
   5/8" Diamondback GlasRoc Type X Tile Backer; CertainTeed Gypsum
   5/8" DensShield Fireguard Type X Tile Backer; Georgia-Pacific Corp
   5/8” Gold Bond Brand eXP Type X Tile Backer; National Gypsum Company
   5/8” Durock Brand Glass-Mat Type X Tile Backer; USG Corporation

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated.
   1. Contractor’s Option: Provide either tile manufacturer’s standard product as stated above, or the following product:
      a. Chlorinated Polyethylene Sheet: Non-plasticized elastomer with non-woven polyester laminated to both sides, nominal 0.030" thickness. Product/manufacturer; NobleSeal CIS; Noble Co.

2.7 ACCESSORIES

A. Metal Floor Transition Trim: Provide RENO-AEU protective edge trim by Schluter Systems L.P. Finish shall be satin anodized aluminum. Height as required to flush out with top of tile flooring.

B. Metal Corner Trim: Provide JOLLY-AC color-coated aluminum corner trim by Schluter Systems L.P. Color shall be selected from manufacturer's complete color range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sweep concrete slab surfaces clean and free of dirt and debris. Remove oil, grease, paint, and dried mortar.

B. Shower Pan Membrane Installation:
1. Coat surface to receive membrane waterproofing with a minimum 3/16" thick coat of bond coat adhesive and in accordance with manufacturer's recommendation and ANSI A 108.5.
2. Provide PVC solvent cement welding of all seams and penetrations including drains.
3. Provide factory fabricated pre-molded inside and outside corners.

C. Shower Wall Tile Base: At showers, install tile backer board. Apply with un-cut long edge at bottom of work. Fasten boards to steel stud framing with Type S bugle head drywall screws spaced 6" o.c. Space fasteners at least 3/8" from edge of board.

D. Concrete Slab-on-grade: Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions and recommendations to produce membrane bonded securely to substrate.

3.2 INSTALLATION

A. General Workmanship:
1. Center and balance areas of tile, if possible.
2. Do not make an excessive amount of cuts. Usually, no cuts smaller than half size should be made. Make all cuts on the outer edges of the field.
3. Smooth cut edges. Install tile without jagged or flaked edges.
4. Fit tile closely where edges will be covered by trim, escutcheons or other similar devices.
5. The splitting of tile is expressly prohibited except where no alternative is possible.
6. Maintain the heights of tilework in full courses to the nearest obtainable dimension where heights, given in feet and inches, are not required to fill vertical spaces exactly.
7. Make corners of all tile flush and level with corners of adjacent tile, with due allowance to tolerances for tile as specified in ANSI A137.1.
8. Keep all joint lines straight and even width, including miters.
9. Thoroughly back-up with thin-set bonding material all thin-set units, molded or shaped pieces; secure firmly in place.
10. Thoroughly back-up with mortar-bed mix thick-bed nosings, coves, curbing, gutters, flat tile and trimmers, molded or shaped pieces; secure firmly in place.
11. Bond coat mix shall not be used to back-up thick-bed trim and angles. Coat all thick-bed trim shapes with 1/32" to 1/16" of bond coat mix.
12. Finish floor and wall areas level and plumb with no variations exceeding 1/8" in 8' from the required plane.
13. Install accessories in tile work to be evenly spaced, properly centered with tile joints, and level, plumb and true to the correct projection. Install accessories at locations and heights designated.
14. Finished tile work shall be clean. Replace pitted, chipped, cracked and scratched tiles.

B. Setting Floor Tile - Thinset:
1. Set floor tile in straight joint pattern using dry-set cement mortar in conformance with ANSI A 108.5.
2. Mix and apply dry-set mortar in conformance with the manufacturer's recommendations. Cover surface evenly and comb with a notched trowel not more than 10 minutes before applying tile.
3. Set tile before initial set of the mortar has taken place. Press and beat tile firmly into place to establish proper and complete bond. Joints shall be close and uniform.

C. Setting Wall Tile:
1. Set base and wall tile over masonry in straight joint pattern using dry-set cement mortar in conformance with ANSI A 108.5.
2. Set base and wall tile of size less than 12" x 12" over gypsum wallboard in straight joint pattern using organic adhesive in conformance with TCA W242 and ANSI A 108.4.
3. Set base and wall tile of size more than 12" x 12" over gypsum wallboard in straight joint pattern using Latex Portland cement mortar in conformance with TCA W243 and ANSI A 108.5.
4. Surfaces to be tiled shall be dry, firm and proper for bond.
   a. Treat gypsum wallboard surfaces with a primer-sealer; caulk openings around pipes and fixtures with a non-hardening waterproof sealant.
   b. Apply leveling coat of sanded dry-set mortar over irregular surfaces if and as required to secure plumb, flat surfaces for the application of tile.
5. Mix and apply mortar and adhesive in conformance with best trade practice and the recommendations of the manufacturer of the materials used. Cover surfaces evenly, with no bare spots, and comb with a notched trowel within 10 minutes of applying tile.
6. Apply tile before skinning of the adhesive or mortar has taken place. Press and beat firmly into place to obtain at least 75 percent contact area of adhesive or mortar on the tile back.
7. If tile is face mounted, remove paper and glue before the adhesive or mortar is firmly set; adjust tiles that are out of line.
8. Provide control joints at all inside corners of wall tile areas. Install sealant in joint. Color as selected by Architect.

D. Setting Floor Tile - Adhesive/Waterproof Membrane:
1. All vertical penetrations and surfaces shall receive integral flashing made by coating both the vertical and horizontal surfaces with 30-50 mils of adhesive/waterproof membrane. Extend not less than 4" up and out from the juncture. Allow to set and then embed woven glass fiber scrim and re-coat with 50-75 mils of adhesive/waterproof membrane.
2. Apply adhesive/waterproof membrane using a serrated mason's trowel at a rate to achieve a thickness of not less than 1/16". Cove tile shall be placed first, followed by floor tile.
3. Set tile as the adhesive/waterproof membrane is spread. Press and beat tile firmly into place to establish proper and complete bond. Joints shall be close and uniform.

E. Grouting:
1. Force a maximum amount of grout into the joints.
2. Clean the joints of cushion-edge tile to depth of cushion. Fill joints of square-edge tile flush with face of tile.
3. Fill all gaps and skips. Mortar shall not show through grouted joints.
4. Finished grout shall be uniform in color, smooth, and without voids and low spots.
5. Grout joint width as recommended by tile manufacturer.
6. Damp cure Portland cement grout for at least 72 hours.

F. Wall Control Joints:
1. Provide a caulked control joint at same width as grout joints, minimum of 1/8”.
2. After tile work and grout are dry, clean the open control joint and roll-in foam rod stock to leave a joint depth of 1/4".
3. Fill the joint with primerless one-part acrylic polymeric sealant. Color shall be as selected by Architect.
4. Tool the sealant smooth.
5. Where tile on wallboard abuts tile on masonry, provide a 1/4" caulked control joint to separate the two areas.

G. Joints at Frames: Where ceramic tile abuts frame, provide a minimum 1/8" caulked expansion joint to separate tile from the frame.
1. After tile work and grout are dry, clean the joint at the frame.
2. Fill the joint with primerless one-part acrylic polymeric sealant.
3. Color shall be as selected by Architect.
4. Tool the sealant smooth.

H. Metal Floor Transition Trim:
1. Provide at transition of ceramic floor tile to lower flooring material (e.g. vinyl composition tile, exposed concrete, etc.) where no marble threshold is detailed.
2. Install as detailed on drawings.
3. Set transition trim prior to installing ceramic floor tile.
4. Set tile up tight to transition trim with a factory cushion edge. Trim shall be flush with top of ceramic tile.
5. After tile work and grout are dry, clean the joint between the trim and the tile.

6. Fill joint between trim and ceramic floor tile with sealant to match grout.

I. Metal Corner Trim:
   1. Provide at all outside corners [and top of wainscot] of ceramic wall tile.
   2. Set metal corner trim prior to installing wall tile.
   3. Set tile up to corner trim with a factory cushion edge. Provide a 1/8” joint between tile and trim. Trim shall be flush with faces of ceramic tile.
   4. After tile work and grout are dry, clean the joint between the trim and the tile.
   5. Fill joint with sealant to match grout.

3.3 CLEANING

A. When the work of other trades is completed, clean down tile and marble surfaces and leave in first class condition.
   1. The use of wire brushes or acids is expressly prohibited.
   2. Replace cracked, broken, and chipped tile with new units.
   3. Correct uneven and stained joints.

END OF SECTION

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SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

A. Samples: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES. Submit a 12" x 12" sample of each type of acoustic panel. Submit a 6" long sample of each component of each type of exposed suspension system.

1.3 QUALITY ASSURANCE

A. Erector Qualifications: This work shall be performed by an experienced erector approved by the acoustical material manufacturer.

B. Pre-ceiling conference:
   1. Prior to start of ceiling grid installation, convene pre-ceiling conference at project site.
   2. Attendance is required by Contractor, installer, and Architect.
   3. Review specifications and drawings of ceiling installation and layout.

1.4 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Before acoustical work is started, all wet work such as concrete and plastering shall be completed and thoroughly dried out.
   2. Acoustical ceiling shall not begin until building has been closed to the weather and suitable mechanical ventilation is supplied to maintain condition ranges of 60°F. to 85°F. at not more than 70% R.H. These conditions shall be maintained prior to, during, and after installation.
   3. Acoustical panels shall be unpacked and allowed to stabilize for a period of 72 hours, in the environment as defined above, prior to installation.

B. Work Sequence:
   1. Do not start acoustical work until mechanical and electrical work to be covered up has been inspected and approved.
   2. Coordinate the related work of other trades involved in the ceiling installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store tile and panel cartons open at each end to stabilize moisture content.

1.6 WARRANTY

A. Acoustic Lay-in Panels: Submit manufacturer's standard 10-year warranty against sagging or warping (defined as greater than 1/8" measured in the panel center) from the date of installation.

1.7 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver maintenance materials to the project site, packaged with protective covering for storage and identified with appropriate labels. Furnish two boxes of full size acoustical ceiling units of each type installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acoustic Lay-in Panels (22A): ASTM E 1264, mineral fiber panels, Class 25 (non-combustible) and having an NRC range of 0.50-0.60.
   1. Sizes: 24" x 24" x 5/8".
   2. Design: Fine, non-directional fissured surface.
   3. Product/manufacturer; standard panels:
      Fine Fissured #1728 with exposed tee configuration by Armstrong World Industries, Inc.
      Fine Fissured HHF- 147 with exposed tee configuration CertainTeed Corporation
      Radar ClimaPlus 2115 (FC); USG Interiors, Inc.
   4. Finish: Washable factory applied vinyl latex paint.
   5. Edges: Square.

B. Suspension System; Acoustic Lay-in Panels: Exposed type for panel ceilings as manufactured by the ceiling panel manufacturer or one of the following:
   Armstrong World Industries, Inc.
   CertainTeed Corp.
   Chicago Metallic Corp./Rockfon
   USG Interiors, Inc.
   1. Components shall be roll-formed from steel to meet ASTM C 635 and conform to the requirements for Intermediate duty structural classification. Exposed main tee runners shall be double web with capped face.
   2. Components shall be electro-zinc coated or hot-dip galvanized and exposed surfaces shall have white enamel finish.
   3. System shall be designed and sized to support the ceiling assembly with a maximum deflection of L/360 of the span.
   4. Color shall be white to match color of lay-in panels.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive acoustical treatment for conditions that will adversely affect the execution and quality of work. Designate any areas of potential interference between ceiling components and components of other trades. Do not start this work until unsatisfactory conditions are corrected.

3.2 CEILING INSTALLATION

A. General: Installation procedures shall meet or exceed the manufacturer's recommendations and ASTM C 636.
   1. Lay out each area so that the panel patterns are symmetrical, joints parallel to walls and borders generally equal in width.
   2. Coordinate the patterns with ceiling lights and grilles in conformance with the reflected ceiling plans and as directed.
   3. Verify types and sizes of light fixtures and grilles to be accommodated and arrange the work accordingly.

B. Suspension: Locate main and cross tee runners to form the indicated patterns.
   1. Use a laser leveling method to direct-suspend the main tees with hangers spaced not more than 48" o.c.
   2. Provide hangers within 6" of the corners of recessed lighting fixtures.
   3. Under steel construction, wrap hangers around or clip or bolt hangers to a structural steel member (not steel deck).
   4. Under bar joists, suspend hangers from top chord or from bottom chord at panel points only.
   5. Under ductwork, employ trapeze system for hanging ceiling.
   6. Do not suspend hangers from ducts, piping, conduit, or fireproofing membrane.
   7. Use a laser beam system to level the main tee runners to within 1/8" in 12 ft. Level with hangers taut; do not make kinks or bends in hangers as a means of leveling.

C. Moldings: Install finish channel and angle moldings where ceilings abut walls, furrings and other intersecting vertical surfaces.

1. Moldings shall be in long lengths, secured to adjoining surfaces with at least two fasteners for each piece or more as may be required. Pull the molding snugly against the vertical surface without any gaps.
2. No molding length shall be less than 3 ft. except at short offsets.
3. Use prefabricated corner pieces where possible to eliminate field mitering.

D. Lay-in Panels: Install the acoustic panels in the exposed suspension system with bottom surfaces flush and in a true, level plane.
   1. Provide hold-down clips at lay-in panels within 6' of exterior exits.

E. Access: Provide access through acoustic panel ceilings with one or more access locations in each room to maintain a maximum spacing of 30 ft. between access panels.

3.3 TOLERANCES

A. Variation from flat and level surface: 1/8 inch in 10 ft.

B. Variation from plumb of grid members caused by eccentric loads: Two degrees (2°) maximum.

3.4 ADJUSTING AND PATCHING

A. Replace damaged members of exposed suspension system. Replace ceiling board and tile that is damaged, installed improperly, or shows visible signs of sagging.

3.5 CLEANING

A. After installation, clean soiled and discolored surfaces. Remove damaged units and replace with new.

END OF SECTION

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SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vinyl composition tile flooring, rubber base, and accessories.

1.2 SUBMITTALS

A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit manufacturer's standard color samples of tile, not less than 3" x 3", full thickness. Submit samples of each accessory, full height or width by not less than 2" length.

B. Concrete Slab Testing
   1. Alkalinity and Adhesion Testing:
      a. Submit result of pH tests.
      b. Submit written documentation of acceptable pH levels of selected flooring manufacturer.
      c. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.
      d. Proceed with installation only after substrates pass testing.
   2. Relative Humidity Probe Tests:
      a. Submit results for in situ relative humidity probe tests.
      b. Submit date and time measurements were made.
      c. Submit locations and depth of probe holes.
      d. Submit temperature and relative humidity in each probe hole.
      e. Submit ambient air temperature.
      f. Acceptable relative humidity is typically 75% or less. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have relative humidity percentage stated as acceptable by manufacturer.
      g. Submit letter from flooring manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
   3. Anhydrous Calcium Chloride Testing
      a. Submit time and date of placement and retrieval.
      b. Submit ambient air temperature and humidity during test duration
      c. Submit manufacturer’s instructions and relative technical data.
      d. Acceptable moisture emission rates are typically 3 Ibs. per 1000 sq. ft. or less, in 24 hours. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
      e. Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.

1.3 DELIVERY

A. Deliver floor materials to the project site in unbroken containers and cartons bearing the manufacturer's labels.

B. Deliver resilient floor materials to an acclimatized building at least 36 hours prior to installation of vinyl composition tile. and 48 hours for installation of rubber products.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: Maintain the temperature inside the building reasonably constant at not less than 65°F. for 48 hours before installation, during installation, and for 48 hours after installation.

B. After installation, maintain temperatures within range recommended by manufacturer, but not less than 55°F. or more than 95°F.

1.5 WARRANTY

A. Rubber Base Warranty: Provide Standard 2-year manufacturers' warranty that materials is free from manufacturing defects.

B. Luxury Vinyl Tile: Provide manufacturer's standard 10 Year Commercial Warranty.

1.6 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to the project site not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern, and size installed. Furnish maintenance materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identifying labels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Luxury Vinyl Tile (15F): ASTM F 1700, Class 3, Type B, 6" x 48", Basis of Design is Armstrong Natural Creations Diamond 10 Technology EarthCuts Color : NA387 Gray Clay

B. Vented Rubber Base (14C): ASTM F 1861, Type TS (rubber, vulcanized thermoset), Style Cove (with top-set toe), 1/8" thick, 4" high, color(s) as selected by Architect. Furnish base in manufacturer's standard lengths. Outside corners shall be factory formed pre-molded units matching base in color and finish. Product/manufacturer; one of the following:
Baseworks™ Thermoset Rubber Wall Base; Johnsonite
Pinnacle Type TS Rubber Base; Roppe Rubber Corp.
NO SUBSTITUTIONS

C. Adhesive: Moisture-resistant type recommended by flooring manufacturer. Use an epoxy adhesive at rubber treads, risers and flooring as recommended by manufacturer. Provide epoxy nose caulking as recommended by manufacturer.

D. Cleaner: Neutral, chemical cleaner such as Hillyard "Super Shine-All" designed to be safe to use on any surface not damaged by water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive resilient flooring, base, and accessories for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Testing of concrete slabs
1. Anhydrous Calcium Chloride Testing
a. Conduct anhydrous calcium chloride testing per ASTM F1869, modified to include testing over concrete containing lightweight aggregate.
b. Environmental requirements of area to be tested are to match that of the finished floor covering. Doors, windows, roofing, etc. must be installed and the temperature of the building controlled to a finished building atmosphere. Ensure interior building climate is 75 degrees F ± 10 degrees F and 50% Relative Humidity ± 10% for 72 hours prior to, and throughout the duration of the tests.
c. The number of test kits required is determined by the square footage of areas scheduled to receive finish flooring. A minimum of three test kits are required in the first 1,000 sq. ft. a minimum of one test kit per each additional 1,000 sq. ft. with consideration given to separation of test areas. Time of exposure is a minimum of 60 hours and a maximum of 72 hours.
d. A prepackaged calcium chloride test kit is equipped with a sealed dish of anhydrous calcium chloride, a metering dome with gasket and instructions.
1) Clean substrate in area to be tested by removing dust solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation, or laitance, mold mildew and other foreign materials.

2) Weigh the tape sealed dish on a gram scale with 1/10th gram gradation. Record start weight, date and time on dish's label and instruction document.
3) Unseal dish and expose test according to preprinted test kit instructions.
4) Allow 60 to 72 hours of exposure. Retrieve test dish re-seal and re-weigh according to instructions.
5) Provide a diagram of the building, with calculations, documenting each test location with its results in writing.

e. Acceptable moisture emission rates are typically 3 lbs. per 1000 sq. ft. or less, in 24 hours; however, submit written tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
f. Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.

2. In Situ Relative Humidity Probe Test:
   a. Conduct in situ relative humidity probe testing per ASTM F2170.
   b. Concrete floor slabs shall be at the service temperature and the occupied air space above the slab shall be at the service temperature service relative humidity far at least 48 hours before taking relative humidity measurements in the concrete slab.
   c. Perform 3 tests for the first 1,000 sq/ft. and a minimum of 1 test for every 1,000 sq/ft. thereafter.
   d. For slabs on-grade and below-grade choose a testing location within 3 feet of each exterior wall.
   e. Drill probe holes 40% into depth of slab for slabs drying from the top only and 20% into the slab for slabs drying from top and bottom.
   f. Remove dust from hole using vacuum cleaner and allow 72 hours to achieve moisture equilibration within hole before taking relative humidity measurements.
   g. After inserting probe allow necessary amount of time for probe to reach temperature equilibrium before measuring relative humidity.
   h. Use the relative humidity probe to measure the ambient air temperature and relative humidity above the slab in the vicinity of the hole.
   i. Proceed with installation only after substrates pass testing.
   j. Submit letter from flooring manufacturer stating that floor relative humidity percentage is acceptable and manufacturer will issue warranty.
3. Alkalinity and Adhesion Testing
   a. Conduct pH test per ASTM F710.
   b. Test for alkalinity prior to installation of flooring materials.
   c. pH levels shall not exceed the written recommendation of the flooring manufacturer and the adhesive manufacturer.
   d. A pH range of 5-9 is optimum, not to exceed 9 pH. Submit written acceptable pH levels of selected flooring manufacturer.
   e. Proceed with installation only after substrates pass testing.
   f. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners. Surfaces shall be clean and dry before flooring is laid.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Sweep the surfaces free of dust and dirt and remove oil, grease, paint, dried mortar and curing compound residue.
4. Fill low spots, cracks, minor holes and crevices in concrete floors with latex underlayment patching material. Re-surface rough and irregular surfaces with the same underlayment material.

3.3 INSTALLATION

A. Applying Rubber Base:
1. Install coved base after the floor tile, mat, and carpet have been laid. Do not use less than manufacturer's continuous rolls, except where required for last piece in any one run of wall length.
2. Apply base with adhesive covering 100% of the back surface, not just in spots. Apply adhesive with a notched trowel. Use headless brads in addition to adhesive where required. Use preformed outside corners and miter inside corners. Joints shall be tight.
3. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

3.4 PROTECTION

A. Repair or replace damaged surfaces that are soiled or scarred in a manner acceptable to the Owner.

3.5 CLEANING

A. Clean in accordance with Section 01 74 13 - PROGRESS CLEANING.
   1. Remove excess adhesive and other foreign matter from tile flooring and base.
   2. Replace defective or loose material.

END OF SECTION

SECTION 09 65 66

RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient athletic flooring.

B. Related Sections:
1. Section 09 65 00 – Resilient Flooring: Rubber base.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES.

B. Product Data: Submit manufacturer's product data, including installation and maintenance instructions

C. Samples: Submit manufacturer's full range of color samples.

1.3 QUALITY ASSURANCE

A. Supplier shall be an established firm experienced in the sales and installation practices of sports flooring.

B. Installer:
1. Flooring contractor shall be experienced in the field and approved by the manufacturer.
2. Flooring contractor shall have the installation and specifications manual and be trained by the manufacturer and/or distributor.
3. Manufacturer's recommendations shall be followed for the correct preparation, finishing, and testing of the subfloor surface.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Flooring contractor shall not deliver to job site until the work of other trades has been completed (especially overhead trades).

B. Installation temperature shall be at least 65° F or maximum 86° F and the moisture content of the slab 3% or lower.

C. Rolls shall be stored upright at all times.

1.5 MAINTENANCE

A. Maintenance shall not begin until 72 hours after the flooring has been installed.

B. No sealers or wax of any kind are required for material to maintain its natural finish.

C. Daily Maintenance: After the floor is installed and open to traffic, dustmop daily using Hillyard Uphold dustmop treatment or equivalent. This will effectively remove dirt, grit, and sand particles which otherwise act as an abrasive material when walked on.

D. Weekly Maintenance:
1. Approximately once a week, scrub the floor with an automatic scrubber and a solution of Hillyard Clean Scrub or equivalent. Depending upon the amount of soil, use 3 to 6 ounces of Clean Scrub or equivalent per gallon of warm water. Remove soiled cleaning solution with an automatic scrubber.
2. After the entire floor is clean and dry before traffic is allowed back on the floor, dustmop with Uphold or equivalent.

1.6 WARRANTY

A. Provide a standard warranty jointly covered by the approved flooring contractor and the manufacturer guaranteeing its materials against manufacturing defects for a period of two (2) years following the installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide “Sport M” flooring as manufactured by Taraflex Sports Flooring with the following characteristics:
   1. Sport surface material shall be a homogeneous 100% pure vinyl wear layer combined with a pure vinyl closed-cell foam backing, reinforced with a fiberglass interlayer. A fungistatic and bacteriostatic treatment shall be applied throughout the thickness of the surface (wear layer and foam backing). Surface shall have a UV cured polyurethane anti-dirt treatment.
   2. Physical Properties:
      a. Surface: Calf Textured
      b. Width of Roll: 4’-11” (1.50 m)
      c. Length of Rolls: 95’ maximum
      d. Total Thickness: 1/4" (6.2 mm)
      e. Weight: 0.9 lbs. / sq. ft. (4.2 Kg / m^2)
      f. Abrasion Resistance Taber ASTM C 501: 109
      g. Static Load Limit: 200 psi
      h. Chemical Resistance ASTM D 543: Excellent
      i. Compression Set ASTM D 595B: Greater than 95% immediate recovery
      j. Linear Dimension ASTM D 1042: Less than 0.50%
      k. Fungus Resistance: ASTM D 1924: Complete
      l. Critical Radiant Flux ASTM E 648: >0.45 W/cm^2 Class 1
      m. Hardness Shore A ASTM D 2240: 81
      n. Sound Isolation ISO 717/2: Δ25dB
      o. Ball Rebound: 98%
      p. Shock Absorbing properties G max of playing surface systems and materials (height 15 cm) ASTM F 355: 940
   3. Colors shall be selected by Architect from manufacturer’s complete color line.

B. Adhesive: To assure complete compatibility with the flooring material, specially compounded adhesives shall be utilized. All adhesives shall be approved by flooring manufacturer and applied in strict accordance with the manufacturer’s instructions.

PART 3 - EXECUTION

3.1 PREPARATION OF THE SUBFLOOR

A. Provide a smooth, flat, concrete finish, achieved manually or mechanically. The slab will have a tolerance of ± 1/8” in a 10’ radius.

B. The concrete floor temperature will have to be maintained at a minimum of 65° F during the installation and the Contractor will make sure that the moisture content does not exceed 3% (according to RMA testing method)

C. Before proceeding with any work, inspect the subfloor surface and report in writing to the Architect any visible defects on the surface such as cracks, bumps, rough areas, or variations in planarity.

D. Check for grease, oil, paint, dust, or any contamination remaining on the concrete subfloor.

E. Before proceeding with material installation, clean the concrete surface to remove any dirt or foreign materials. Sanding of the subfloor is mandatory.

F. Patch and repair all cracks, voids, and other imperfections of concrete with high-strength portland cement-based patching material – Ardex K-15. Do not use gypsum-based patching materials. If concrete is out of level, then it should be properly leveled by an experienced underlayment contractor using cement-based material that will provide a minimum of 3,000 psi compressive strength and sufficient bond to existing clean

concrete surface – Ardex K-15. After completion of sanding, patching, and leveling, vacuum or sweep entire surface of concrete to remove loose dust and dirt before starting the installation of material.

3.2 INSTALLATION

A. Adhesion:
1. Methods:
   a. Glue material to subfloor no sooner than 24 hours after the material has been laid in position.
   b. Use an acrylic type adhesive, applied with a fine tooth notched trowel, giving coverage of between 100 to 150 s.f. per gallon.
   c. Recommended Adhesives: W.W. Henry #234 or Chapco #314 or equal (as approved by the manufacturer). To maintain this rate of coverage, trowel blades need to be renewed frequently.
   d. Recommended trowel gage: 1/16" x 1/16" x 1/16" square notched. Throwawy blades are recommended to maintain proper notch size Use one blade for approximately 700 s.f. of floor area.
2. Recommendations:
   a. Follow adhesive manufacturer's instructions after the material has been in place for 24 hours.
   b. Respect the open time of the adhesive, which will vary according to temperature, humidity, porosity, and absorption rate of the subfloor.
   c. Insufficient open time will cause bubbling. Too long an open time will result in poor adhesive transfer. NOTE: Do not install equipment or allow foot traffic on the floor for a minimum of 48 hours following installation to allow the adhesive to set properly (see manufacturer's instructions).

B. Installation of Sheets:
1. Strike a chalk line across the center of the playing area. Be sure that the line is square to the room.
2. Lay the first length of flooring along this chalk line and the work progressively outward, leaving a small gap between sheets to allow the material to relax.
3. Material should be unrolled in place for 24 hours prior to adhesion.
4. Starting from the center line and working outward, fold the sheets back halfway and apply the adhesive to the subfloor.
5. Position the first half into the adhesive, then repeat this process with the second half.
6. Continue laying sheets by butting the edges or overlapping and double cutting through both sheets using a straight edge.
7. Rolling is done in two stages.
   a. Manually: Immediately after material is positioned onto the adhesive.
   b. Using a roller: Roll entire surface crossways using a 75-lb (minimum) flooring roller.
8. Seaming of Joints (Heat Welding Method):
   a. Mechanical routing using an electric routing machine by Leister equipment Company or equal approved by manufacturer.
      1) Foam-Backed Sheet: Rout only through depth of wear layer.
      2) Non-Foam-Backed Sheet: Rout to 3/4 of total thickness.
   b. Manual Seaming:
      1) This must be done with a heat welding gun with variable temperature control and a speed weld nozzle by Leister Equipment Company or equal approved by manufacturer.
      2) Nozzle size is 5mm.
      3) Avoid forcing welding rod into the seam to ensure a satisfactory finish.
      4) For all types of welding equipment, observe manufacturer's instructions, particularly with regard to speed of welding.
      5) Chalk both sides of the seam to avoid scorching and shining of the material during welding procedures.
   c. Mechanical Welding (required in large areas): This is done using a Leister type automatic welding machine with a variable temperature hot air gun and multi-outlet nozzle. Set the pressure of the guide to avoid forcing the weld into the seam (see tool manufacturer's installation procedure).
   d. Finishing: Trimming is done in two stages once the welding rod and material have cooled.
      1) First, trim using a cable slide.
      2) Second, trim fluch with the floor using a spatula or hook-billed knife.
      3) After the welding rod is trimmed smooth or flush with the top surface, check the entire seam to ensure that the welding cord is bonded properly and is flush with the top wear layer.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Decorative epoxy-resin flooring consisting of colored quartz aggregate in an epoxy matrix.

1.2 SUBMITTALS

A. Product Data: For each type of primer

B. oduct specified. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

C. Samples for Verification: Of each resinous flooring system required, 6 inches square, applied by Installer for this Project to a rigid backing, in color, texture, and finish indicated. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results of the resinous flooring's reaction to chemicals and other reagents and substantiating compliance with requirements.

F. Material Certificates: In lieu of material test reports, when permitted by Architect, signed by manufacturers certifying that materials furnished comply with requirements.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

C. Field Samples: On floor area selected by Architect, provide full-thickness resinous flooring system samples that are at least 48 inches square to demonstrate texture, color, thickness, chemical resistance, cleanability, and other features of each resinous flooring system required. Simulate finished lighting conditions for review of in-place field samples.
   1. If field samples are unacceptable, make adjustments to comply with requirements and apply additional samples until field samples are approved.
   2. After field samples are approved, these surfaces will be used to evaluate resinous flooring.
   3. Obtain Architect's approval of field samples before applying resinous flooring.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work Include, but are not limited to:
Dex O-Tex, Division of Crossfield Products Corp. (phone 310.886.9100 web site: www.dexotex.com)
General Polymers, Inc., Division of Sherwin-William (phone 800.543.7694 web site: www.generalpolymers.com
Key Resin Company (phone 888.943.4532 web site: www.keyresin.com)
T&M Terroxy Resin Systems (800) 762-7253 web site: www.tmsupply.com

1. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for resinous flooring complying with requirements indicated.
2. Total Thickness of Body Coat(s): As recommended by manufacturer for system compliance with requirements.
3. System Thickness: Minimum 3/8 inch.
4. Wearing Surface: Antislip.
5. Base: 4 inch high integral cove base.
6. Components: Provide manufacturer's standard components complying with requirements, unless otherwise indicated. Provide the following optional components where recommended by the manufacturer for intended uses and locations:
   a. Primer. Resin manufacturer's 100% solids epoxy primer
   b. Reinforcing membrane: Manufacturer's 100% Solid Epoxy Crack Suppression Membrane.
   c. Chemical-resistant sealing or finish coat(s).

B. Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to standard test methods indicated:
1. Compression Strength: 12,500 psi per ASTM C 579.
2. Tensile Strength: 2,600 psi per ASTM C 307.
3. Flexural Modulus of Elasticity: 4,500 psi per ASTM C 580.
4. Water Absorption: 0.04 percent maximum per ASTM D 570.
5. Indentation: 0.025 percent maximum per MIL-D-3134.
6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch per MIL-D-3134.
8. Abrasion Resistance: 24 mg maximum weight loss per ASTM D 2047.
9. Flammability: Self-extinguishing per ASTM D 635.
10. Hardness: 75-80, Shore D per ASTM D 2240.
11. Bond Strength: 400 psi, 100 percent concrete failure per ACI 503R.

C. Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 543, Procedure A, for immersion in the following reagents for not less than 7 days:
1. Ammonium hydroxide, carbon tetrachloride, citric acid, dimethyl formamide, formaldehyde (3%), heavy-duty detergent, heptane, hydrogen peroxide (28%), lactic acid, oleic acid, phenol solution, sodium carbonate (20%), sodium chloride (10%), sodium hydroxide (60%), sodium hypochlorite, sulfuric acid (30%), urine.

2.2 MATERIALS

A. Resinous Flooring (15C): Resinous floor surfacing system consisting of primer; body coat(s) including resin, hardener, aggregates, and colorants, if any; and sealing or finish coat(s).
   1. Reinforcing Membrane: Manufacturer's flexible resin recommended for crack isolation to help prevent substrate cracks from reflecting through resinous flooring.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrate according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminates incompatible with resinous flooring.
   1. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
   2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrate according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
   4. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply reinforcing membrane to substrate cracks or entire substrate surface as recommended by manufacturer.

D. Apply self-leveling slurry body coat(s) in thickness indicated.

E. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.

F. Integral Cove Base: Apply cove base mix to wall surfaces adjacent floor applications unless otherwise indicated. Round internal and external corners. Install cove base according to manufacturer's written instructions and details including taping, mixing, priming, troweling, sanding, and topcoating of cove base.

G. Apply sealing or finish coat(s), including grout coat, if any, of type recommended by resinous flooring manufacturer to produce finish indicated. Apply in number of coats and at spreading rates recommended in writing by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any number of times during flooring application require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified and sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's Product Data.
   3. If test results show installed materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.4 CLEANING AND PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

B. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of substantial completion in each project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: On-the-job painting and finishing of exterior and interior surfaces.
   1. Included: Paint and finish the following materials, fittings, and equipment items which are exposed-to-view.
      a. Iron, steel, and galvanized metal.
      b. Wood.
      c. Concrete masonry units.
      d. Interior concrete ceiling and beam surfaces.
      e. Gypsum board.
      f. Interior caulked joints.
      g. Portland cement plaster.
      h. Bare and insulation covered piping and ductwork, conduit, hangers, grilles and registers, and primed metal surfaces and factory-finished surfaces of mechanical and electrical equipment.
   2. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, including the following:
      a. Factory-finished metal lockers and finished light fixtures.
      b. Architectural aluminum and stainless steel.
      c. Interior concrete floors and steps and all exterior concrete.
      d. Acoustic panel ceilings, unless noted on drawings.
      e. Pre-finished cabinets.
      f. Operating parts: Moving parts of operating mechanical and electrical equipment, such as: valve and damper operators, linkages, sensing devices, motor and fan shafts
      g. Labels: UL, FM, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
   3. Contractor shall examine the drawings for mechanical and electrical work, and all materials installed throughout the building which require painting shall be painted under this section of the specifications.

B. Related Sections:
   1. Section 05 12 00 - Structural Steel Framing: shop priming of structural steel.
   2. Section 05 21 00 - Steel Joists Framing: shop priming of steel joists.
   3. Section 05 50 00 - Metal Fabrications: shop priming of metal fabrications.
   4. Section 09 99 00 - Color Schedule.

1.2 SYSTEM DESCRIPTION

A. For purposes of this painting specification, the following areas and spaces are not considered finished, occupied areas and there will be no painting therein except for doors and frames and as may be specifically scheduled in article paint schedule.
   1. Mechanical chases.
   2. Spaces above suspended ceilings.

1.3 SUBMITTALS

A. Samples:
   1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
   2. Submit two 8-1/2" x 11" samples of each paint color scheduled on the color schedule prepared by the Architect. Samples shall be on heavy cardboard and shall be made with the actual mixed paints to be used on the project.
   3. Samples for Initial Selection of each type of texture finish product.

B. Paint Schedule: If painting materials other than those specified are proposed for use, submit a complete schedule of the materials to be substituted. This schedule, in triplicate, shall be in the same form as the paint schedule included in this section, and shall list materials by manufacturer, brand name, and type for each surface to be finished.

C. Federal law requires renovation firms (including sole proprietorships) to be certified and requires individuals to be trained in the use of lead-safe work practices. Contractors who perform renovation, repairs, and painting jobs shall:
   1. Provide a copy of your EPA lead training certificate.
   2. Show what lead-safe methods you will use to perform the job.
   3. Provide references from at least three recent jobs involving projects before 1978.
   4. Keep records to demonstrate that you and your workers have been trained in lead-safe work practices and that you follow lead-safe work practices on the job.

D. Close-out Schedule: Upon completion of work, furnish a full schedule of paint types and colors actually used and formulas for each to the Owner.

1.4 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 3 years' experience.

B. Applicator: Company specializing in commercial painting and finishing with 2 years' experience.

C. Product Labels: Include manufacturer's name, type of paint, stock number, color and label analysis on label of containers.

D. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as final coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

E. V.O.C. (Volatile Organic Compound) Compliance: Products listed in the schedules and/or substitutes proposed for use by Contractor must be formulated to meet all applicable ordinances and regulations regarding maximum V.O.C. content. Utilize products which have been specially formulated to meet such requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in original containers with seals unbroken and labels intact.

B. Storage: Contractor shall designate a specific space at the project site for storing and mixing materials. Protect this space and repair all damage resulting from use. Do not store kerosene nor gasoline in this space. Remove oily rags at the end of each day's work.

1.6 PROJECT CONDITIONS

A. Environmental Requirements: Maintain the temperature inside the building at not less than 60°F. during painting and finishing.

B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 65°F. for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

C. Minimum application temperatures for latex paints: 45°F. for interiors; 50°F. for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum application temperature for varnish and finishes: 65°F. for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft.-candles measured mid-height at substrate surface.

F. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified during application and drying periods of 24 hours between coats and 72 hours after final coat.

G. Protection: Provide sufficient drop cloths to fully protect adjacent finished work.

1.7 PRECAUTIONS

A. Do not store paints, oils, thinners and other flammable items inside the building. They shall be stored in approved containers when not in actual use during the painting job. The fire hazard shall be kept at a minimum.

B. Take precautions to protect the public and construction workers during the progress of the work.

C. Furnish a temporary fire extinguisher of suitable chemicals and capacity, located near flammable materials.

1.8 MAINTENANCE

A. Extra Materials: Upon completion of the work, deliver to project site 2 gallons of each type and color of paint applied to interior and exterior surfaces. Provide formula for custom match colors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide paint as manufactured by one of the following:
Kelly-Moore Paint Co. (http://www.kellymoore.com)
PPG Paints (http://www.ppgpaints.com)
The Sherwin-Williams Co. (http://www.sherwin.com/default.asp)

B. Materials described are based on the specifications of the above listed manufacturers, and are given to designate the quality of materials required. Materials of best quality grade are representative of the standard of quality required. Materials not displaying manufacturer's identification as a first line, best-grade product will not be acceptable.

C. Colors: The Architect will prepare a color schedule. The Architect has prepared a color schedule; reference SECTION 09 99 00 - COLOR SCHEDULE. Regardless of which brand of paint is selected for use the Contractor shall intermix and blend as required to obtain an exact match to each color on the color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Architect any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum wallboard: 12 percent.
2. Interior located wood: 15 percent, measured in accordance with ASTM D 4442.
3. Concrete: 12 percent.
4. Masonry: 12 percent.
5. Plaster: 12 percent

D. Test shop-applied primers for compatibility with subsequent cover materials.

E. Perform the following Test procedure prior to painting. This will determine if Passivators exist on galvanized metal. This procedure is not necessary on galvanized metal with G 90 Paint Grip.
1. Prepare a solution by dissolving 20 grams of copper sulfate in one liter (1000 grams) of water. Copper sulfate crystals may be purchased at most drug stores.
2. Solvent wash a small area per the procedure of SSPC-SP1.
3. Sand a small washed area using emery cloth.
4. Using a cotton swab saturated with the copper sulfate solution, apply a swipe to both sanded and unsanded washed areas.

5. If the sanded and unsanded surfaces turn black at the same time and that time is less than 10 seconds, there is no passivation on the surface other than light oil, and a normal degreasing/cleaning operation is sufficient preparation prior to the coating application. If the unsanded surface turns slower than the sanded surface, or not at all, a passivator of some type is present on the surface. If neither surface turns, the surface is probably an alloy of zinc or some other metal.
6. If the galvanized steel has been treated or passivated, the treatment or passivator must be removed by brush blasting. If this method is prohibited by environmental regulations, then chemical etching with Amchem's GALVAPREP SG-3 will be acceptable, if previously approved by the Architect. The chemical etching manufacturer's procedures should be followed carefully.
7. If the surface is determined to be an alloy by this test procedure, notify Architect and adhesion tests of the proposed coating applied over the proposed surface preparation must be conducted.
8. If no passivators are present, wash galvanized metal surfaces with mineral spirits to remove residual grease and oil.

F. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

A. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions for each substrate condition.

B. Fill open joints, cracks and crevices on steel buck frames with metal putty and sand smooth before painting.

C. Sand woodwork surfaces smooth before priming.

D. Coat pine knots and pitch streaks with shellac before painting.

E. Putty nail holes after the prime coat.

F. Remove hardware and accessories, plates, lighting fixtures and similar items which are not to be finish-painted or provide adequate surface-applied protection for these items in place.

G. Uncoated steel and iron surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

H. Shop primed steel surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.3 APPLICATION

A. Workmanship shall be of the highest quality. Mix and use paint materials in accord with the manufacturer's directions. Spread materials evenly, flow smoothly, and brush out without sags or runs.

B. Provide finish coats which are compatible with primer paints used. Provide barrier coats over incompatible primers where required.

C. When undercoats, stains or other conditions show through final paint coat, apply additional coats until paint film is of uniform color and sheen.

D. Finish the insides of wood cabinets, including backs of cabinet doors, as scheduled for the fronts and ends.

E. Between coats, sand enamel and lacquer finish on wood and metal surfaces to produce a smooth, even finish. Use #220 grit sandpaper or finer.

F. Tint priming coats and undercoats to approximate shade of final coat to assure uniformity of color in the finish. Touch up suction spots and "hot spots" before applying the last coat to produce an even result in the finish coat.

G. Exposed ductwork, piping and conduit in finished, occupied areas shall be painted the same color as the wall or ceiling against which it is installed, unless otherwise noted.

H. Apply the finish coat on gypsum board, plaster, and concrete surfaces with rollers.

I. On concrete masonry unit wall surfaces without a block filler, apply the first coat of paint with a spray gun.

3.4 TOUCH UP AND CLEAN

A. Touching Up: On completion, carefully touch up all holidays, marred and damaged spots, and work over all surfaces that have been repaired by other trades.

B. Cleaning: Remove spilled, splashed, and splattered paint from all surfaces. Do not mar surface finish of item being cleaned.

C. Reinstall the items removed under the provisions of paragraph above.

3.5 PAINT SCHEDULE

A. The products listed below represent top of the line products of each manufacturer. These products are not presented as being equivalent, as there are too many variables to match each product across the board. Manufacturer's designations are:
   KM Kelly-Moore Paint Co.
   PPG Pittsburgh Paints
   SW The Sherwin-Williams Co.

B. Interior Metal
   1. Steel door frames, borrowed light frames, louvers and vision panel frames in doors, hollow metal doors, sound retardant doors, and ladders.
      1 primer coat
         KM 1710--Kel-Guard Zinc Chromate Red Oxide Primer
         PPG Red Inhibitive Steel Primer, 6-208
         SW Kromik Metal Primer E41N1
      2 finish coats
         KM 1630--Kel-Cote Alkyd Semi Gloss Enamel
         PPG Speedhide 6-1110
         SW ProMar 200 Alkyd Semi-Gloss Enamel, Series B34 W 200
   2. Steel pipe handrails and railings.
      1 primer coat
         KM 1710--Kel-Guard Zinc Chromate Red Oxide Primer
         PPG Red Inhibitive Steel Primer, 6-208
         SW Kromik Metal Primer E41N1
      2 finish coats
         KM 1700--Kel-Guard Rust Inhibitive Enamel
         PPG Int/Ext Industrial Gloss Alkyd, 7-282 Series
         SW Industrial Enamel, Series B54
   3. Grilles, diffusers and registers in walls and ceilings.
      1 finish coat
         KM 1620--Kel-Cote Alkyd Eggshell Enamel
         PPG Speedhide Alkyd Lo-Sheen, 6-90
         SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200
   4. Other exposed iron and steel.
      1 primer coat
         KM 1711--Kel-Guard White Rust-Inhibitive Primer
         PPG Speedhide Inhibitive Steel Primer, 6-208
         SW Kem Kromik Metal Primer, B50 W 1
      1 finish coat
         KM 1620--Kel-Cote Alkyd Eggshell Enamel
         PPG Speedhide Alkyd Lo-Sheen, 6-90
         SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200

5. Metal ductwork, hangers, supports and brackets.
    1 primer coat
        KM 1722--Kel-Guard Galvanized Iron Primer
        PPG Speedhide White Galvanized Steel Primer, 6-209
        SW Galvite Paint, B50 WZ30
    1 finish coat
        KM 1620--Kel-Cote Alkyd Eggshell Enamel
        PPG Speedhide Alkyd Lo-Sheen, 6-90
        SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200
6. Items of mechanical and electrical machinery and equipment.
    1 finish coat
        KM 1700--Kel-Guard Rust Inhibitive Enamel
        PPG Int/Ext Industrial Gloss Alkyd, 7-282 Series
        SW Industrial Enamel, Series B54

C. Interior Wood
1. Wood shelving and millwork.
    1 primer coat
        KM 985--Flo-Cote Enamel Undercoat
        PPG Speedhide Quick-Drying Enamel Undercoater, 6-6
        SW ProMar 200 Alkyd Enamel Undercoater, B49 W 200
    1 finish coat
        KM 1630--Kel-Cote Alkyd Semi-Gloss Enamel
        PPG Speedhide Interior Semi-Gloss Alkyd Enamel 6-1110 Series
        SW ProMar 200 Alkyd Semi-Gloss Enamel, Series B34 W 200
2. Inside of cabinet drawers.
    1 finish coat clear satin polyurethane
3. Hardwood millwork, doors, and trim.
    1 coat stain; color as selected by Architect.
    1 coat clear sanding sealer
    2 coats clear satin polyurethane

D. Interior Masonry (At sound absorbing concrete masonry unit blocks, do not paint fibrous fillers)
1. Concrete masonry unit walls scheduled to have Epoxy Paint.
    1 filler coat
        KM 521--Acrylic Block Filler
        PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
        SW Heavy Duty Block Filler, B42 W 46
    2 finish coats
        KM 1790 Kel-Guard Acrylic Epoxy
        PPG Auquapon WB Waterborne Gloss Epoxy coating 98-1 Series
        SW Water-Based Catalyzed Epoxy, Series B70, Gloss Hardener
2. Concrete masonry unit walls in Activity Room/Gymnasium
    1 filler coat
        KM 521--Acrylic Block Filler
        PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
        SW Heavy Duty Block Filler, B42 W 46
    2 finish coats
        KM 1650--Acry-Plex Latex Semi-Gloss Enamel
        PPG Speedhide Interior Acrylic Latex Semi-Gloss Enamel, 6-510 Series
        SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200
3. Other concrete masonry unit walls.
    1 filler coat
        KM 521--Acrylic Block Filler
        PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
        SW Heavy Duty Block Filler, B42 W 46
    2 finish coats
        KM 1650--Acry-Plex Latex Semi-Gloss Enamel
        PPG Speedhide Interior Acrylic Latex Semi-Gloss Enamel, 6-510 Series
        SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

E. Gypsum Wallboard
1. Gypsum board ceilings and furr downs.
1 texture coat
USG Multi-Purpose Texture - Sprayed Splatter - Light Finish Texture
PPG Speedhide Acrylic Texture Coating 4-50
3 finish coats
KM 550--Super Latex Flat Wall Paint
PPG Speedhide Interior Flat Latex 6-70 Series
SW ProMar 200 Latex Flat Wall Paint, Series B30 W 200
2. Gypsum board walls scheduled to have Epoxy Paint.
1 primer coat - fine sanded texture
KM 970--Acry-Plex Hi-Hide Vinyl Wall Sealer
SW ProMar 200 Latex Wall Primer, B28 W 200
2 finish coats
KM 1790 Kel-Guard Acrylic Epoxy
PPG Aquapon WB Waterborne Gloss Epoxy Coating 98-1 Series
SW Water-Based Catalyzed Epoxy, Series B70, Gloss Hardener
3. All other gypsum board walls.
1 texture coat
USG Multi-Purpose Texture - sprayed splatter medium-light finish texture
PPG Speedhide Acrylic Texture Coating 4-50
1 primer coat
SW PrepRite 200 Latex Wall Primer B28W200 or approved equivalent
2 finish coats
KM 1650--Acry-Plex Latex Semi-Gloss Enamel
PPG Speedhide Interior Semi-Gloss Latex Enamel 6-510 Series
SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

F. Interior Fiberglass Reinforced Gypsum
1 primer coat
SW ProMar 200 Latex wall primer, B28W200 or approved equivalent.
PPG Speedhide Int/Ext Acrylic Alkali Resistant Primer 6-603
2 finish coats
SW ProMar 200 Latex Semi-gloss, B31W200 or approved equivalent.
PPG Speedhide Interior Semi-Gloss Latex Enamel 6-500 Series

G. Interior Caulked Joints
1. Caulking
2 finish coats
KM 1650--Acry-Plex Latex Semi-Gloss Enamel
PPG Speedhide Interior Semi-Gloss Latex Enamel 6-510 Series
SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

H. Exterior Metal
1. Steel door frames and hollow metal doors.
1 primer coat
KM 1710--Kel-Guard Zinc Chromate Red Oxide Primer
PPG Speedhide Int/Ext Rust Inhibitive Steel Primer 6-208 Series
SW Kromik Metal Primer E41N1
2 finish coats
KM 1700--Kel-Guard Rust Inhibitive Enamel
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54
2. Steel pipe, conduit, hangers supports and brackets.
1 primer coat
KM 1722--Kel-Guard Galvanized Iron Primer
PPG Speedhide Int/Ext Galvanized Steel Primer 6-209
SW Galvite Paint, B50 WZ30
1 finish coat
KM 1700--Kel-Guard Rust Inhibitive Enamel
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54

3. Galvanized steel pipe handrails, railings, lintels, gates, metal fencing, ladders, ductwork, flashings, copings, roof hatches, tubular steel downspouts, galvanized gutters and downspouts, scuppers, ventilators, and louvers. (Reference test procedure for Passivators)
    1 primer coat
        KM 1722--Kel-Guard Galvanized Iron Primer
        PPG Speedhide Int/Ext Galvanized Steel Primer 6-209
        SW Galvite Paint, B50 WZ30
    2 finish coats
        KM 1700--Kel-Guard Rust Inhibitive Enamel
        PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
        SW Industrial Enamel, Series B54
4. Items of mechanical and electrical machinery and equipment, including mechanical and electrical equipment on the roof which are 12" above roof line and are not concealed by a screen.
    1 finish coat
        KM 1700--Kel-Guard Rust Inhibitive Enamel
        PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
        SW Industrial Enamel, Series B54

I. Exterior Plaster
1. Cement plaster surfaces with integral color.
    1 finish coat
        KM 1105 Kel-Crete Acrylic Masonry Finish
        PPG Speedhide Exterior Flat Acrylic Latex 6-610 Series
        SW A-100 Exterior Flat, A6-100 Series

J. Exterior Concrete Masonry Units
    1 filler coat
        KM 521--Acrylic Block Filler
        PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
        SW Heavy Duty Block Filler, B42 W 46
    2 finish coats
        KM 1105 Kel-Crete Acrylic Masonry Finish
        PPG Speedhide Exterior Flat Acrylic Latex 6-610 Series
        SW A-100 Exterior Flat, A6-100 Series

K. Exterior Wood
1. Siding, trim, doors, hardboard, miscellaneous wood
    1 primer coat
        KM 220 Exterior Primer
        SW A-100 Alkyd Exterior Wood Primer, Y24 W 20
        PPG Speedhide Exterior Alkyd Wood Primer 6-9
    2 finish coats
        KM 1250 Acry-Lustre Acrylic Semi-Gloss
        SW DTM Acrylic Semi-Gloss Coating, B66 Series
        PPG Speedhide Exterior Semi-Gloss Acrylic Latex 6-900 Series
2. T-1-11 Plywood Soffits
    1 primer coat
        KM 250 Acrylic Primer Sealer
        SW S-W A-100 Exterior Latex Primer, B42W41
        PPG Speedhide Exterior Latex Wood Primer 6-609
    2 finish coats
        KM 1245 Acry-Velvet Acrylic Low Sheen
        SW S-W A-100 Satin Latex House & Trim, A82 Series
        PPG Speedhide Exterior Satin Acrylic Latex 6-2045 Series

L. Exterior Glass Fiber Reinforced Concrete
    1 primer coat
        SW Loxon Exterior Masonry Primer, A24W300 or approved equivalent.
        PPG Speedhide Int/Ext Acrylic Alkali Resistant Primer 6-603
    2 finish coats
        SW Loxon Exterior Coating, A24W301 or approved equivalent.
        PPG Pitt-Flex Exterior Acrylic Elastomeric Masonry Coating 4-110

M. Exterior Cement Fiber Cement Panels
1. Fiber Cement
1 Primer Coat:
S-W Loxon Exterior Acrylic Masonry Primer, A24W300
2 finish coats
S-W A-100 Exterior Latex Flat, A6 Series

END OF SECTION

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SECTION 09 99 00

COLOR SCHEDULE

THE COLOR SCHEDULE IS ISSUED AS A REFERENCE FOR COLOR SELECTIONS ONLY. THE COLOR SCHEDULE SHALL NOT TAKE PRECEDENCE OVER THE INDIVIDUAL SPECIFICATION SECTIONS. IF THERE IS A DISCREPANCY BETWEEN SPECIFICATION FINISHES AND COLOR SCHEDULE, NOTIFY ARCHITECT PRIOR TO ORDERING MATERIAL.

PROJECT NAME - **Gym Addition to Smithfield Middle School**
BIRDVILLE ISD

PROJECT NO. 1887.00
DATE 8-May-2019
REVISED 8-May-2019

MARK	COLOR KEY	ITEM	SPEC. SECTION	MANUFACTURER/ DESCRIPTION	REMARKS
1A	1A	SEALED MONOLITHIC CONCRETE	03 30 00	AS SPECIFIED	
3L	3L-1	12" X 24" PORCELAIN TILE	09 30 13	MFG: Florida Tile STYLE: Sequence COLOR: Breeze 34901	Typical Wall Tile
	3L-2	12" X 24" PORCELAIN TILE	09 30 13	MFG: Crossville STYLE: Shades By Crossville COLOR: Ash AV246	Typical Floor Tile
	G1	GROUT	09 30 13	CUSTOM BLDG PROD COLOR: #386 Oyster Gray	Grout for 3L-1
	G2	GROUT	09 30 13	CUSTOM BLDG PROD COLOR: #540 Truffle	Grout for 3L-2
4A	4A-1	BRICK VENEER	04 20 00	AS SPECIFIED Color: CRIMSON BL-3 MOD VEL	Typical Brick Veneer
	4A-2	BRICK VENEER	04 20 00	AS SPECIFIED Color: DOESKIN	Beige Accent Brick Veneer
	4A-3	BRICK VENEER	04 20 00	AS SPECIFIED Color: GLACIER WHITE	White Accent Brick Veneer
6A	6A	CONCRETE MASONRY UNITS - PAINT	04 20 00 or 04 22 00	AS SPECIFIED	- REMARKS
6C	6C	ACOUSTIC CMU - PAINT	04 20 00	AS SPECIFIED	- REMARKS
6EP	6EP	CONCRETE MASONRY UNITS - EPOXY PAINT	04 20 00	AS SPECIFIED	- REMARKS
9A	9A	OAK STRIP FLOORING	09 64 29	AS SPECIFIED	- REMARKS
14B	14B	RUBBER BASE - COVED	09 65 00	MFG: Roppe STYLE: Pinnacle COLOR: Snow161	

MARK	COLOR KEY	ITEM	SPEC. SECTION	MANUFACTURER/ DESCRIPTION	REMARKS
14C	14C	RUBBER BASE - VENTED	09 64 53	AS SPECIFIED Color: Black	Gymnasium Base
15C	15C	RESINOUS FLOORING	09 67 23	MFG: Dex O-Tex COLOR: BX-425	Locker Room Flooring & Cove Base
15F	15F	18" X 18" LUXURY VINYL TILE	09 65 00	MFG: Armstrong STYLE: Natural Creations Diamond 10 Technology EarthCuts COLOR: NA387 Gray Clay	Corridors & Lobby Flooring
19A	19A	FLOOR MATS - LOOSE LAID	12 48 13	AS SPECIFIED	
19C	19C	WALK-OFF CARPET	12 48 13	AS SPECIFIED	
20A	P-1	GYPSUM WALLBOARD - PAINT	09 21 16	AS SPECIFIED	
20EP	P-1	GYPSUM WALLBOARD - EPOXY PAINT	09 21 16	AS SPECIFIED	
21ES	P-1	EXPOSED STRUCTURE - PAINT	09 91 00	AS SPECIFIED	
22A	22A	2' X 2' ACOUSTIC LAY-IN PANELS	09 51 00	AS SPECIFIED	
		INTERIOR PAINT			
	P-1	INTERIOR PAINT	09 91 00	MFG: Kelly Moore COLOR: KM043 Whitest White	Typical Wall and Ceiling Paint
	P-2	INTERIOR PAINT	09 91 00	MFG: Sherwin Williams COLOR: SW7016 Mindful Gray	Light Gray Accent Paint
	P-3	INTERIOR PAINT	09 91 00	MFG: Sherwin Williams COLOR: SW7018 Dovetail	Dark Gray Accent Paint
	P-4	INTERIOR PAINT	09 91 00	MFG: Sherwin Williams COLOR: SW9177 Salty Dog	Blue Accent Apaint
		EXTERIOR PAINT			
	P-5	EXTERIOR PAINT	09 91 00	MFG: SHERWIN WILLIAMS COLOR: Match Existing	Exterior & Interior H.M. Doors & Frames
		PLASTIC LAMINATE			
	PL-1	PLASTIC LAMINATE-FACED WOOD DOORS	08 14 23	MFG: COLOR:	- REMARKS
	PL-2	PLASTIC LAMINATE-CABINETS	06 40 00	MFG: Wilsonart COLOR: North Sea D90-60 Finish: Matte	Concessions cabinet fronts & toe-kicks
		SOLID SURFACE			
SLD	SLD-1	SOLID SURFACE	06 40 00	MFG: Staron COLOR: Sanded Grey SG420	Concessions Countertop
		MISCELLANEOUS			

MARK	COLOR KEY	ITEM	SPEC. SECTION	MANUFACTURER/ DESCRIPTION	REMARKS
		DOORS AND DRAWER PULLS AT MILLWORK	06 40 00	COLOR: Stainless Steel	- REMARKS
		PREFINISHED METAL COPING	07 62 00	AS SPECIFIED	
		PREFINISHED GUTTERS & DOWNSPOUTS	07 62 00	AS SPECIFIED	
		EXPANSION JOINT ASSEMBLIES	07 95 13	COLOR: Anodized Aluminum	
		PREFINISHED STOREFRONT	08 41 13	COLOR: Anodized Aluminum	
		EXTERIOR DOOR PULLS AND PUSH BARS	08 71 00	AS SPECIFIED	
		LOUVERS	08 91 00	AS SPECIFIED	
		METAL CORNER TRIM & TILE TOP CAP	09 30 13	MFG: Schluter Systems STYLE: RONDEC FINISH: Satin anodized aluminum	Tile Outside Corner Trim & Top Cap
		METAL TRANSITION STRIP	09 30 13	MFG: Schluter Systems STYLE: RENO-U FINISH: Satin anodized aluminum	Porcelain To LVT
		GAMELINE COLORS (resilient wood flooring)	09 64 53	COLOR: Black	
		GAMELINE COLORS (resilient wood flooring)	09 64 53	COLOR: White	
		GAMELINE COLORS (resilient wood flooring)	09 64 53	COLOR: Blue	
		TACKBOARDS	10 11 16	VINYL COLOR: KB662 Grey	
		INTERIOR ROOM IDENTIFICATION - SIGNS	10 14 00	AS SPECIFIED	
		SOLID PLASTIC TOILET COMPARTMENTS	10 21 15	MFG: Scranton STYLE: Hiney Hiders COLOR: Shale	
		CORNER GUARDS	10 26 13	COLOR: Match adjacent wall color	
		FIRE EXTINGUISHER CABINET	10 44 13	AS SPECIFIED	
		LOCKERS	10 51 00	MFG: DeBourgh COLOR: Navy Blue	
		PREFABRICATED WALKWAY COVER	10 73 26	AS SPECIFIED	

MARK	COLOR KEY	ITEM	SPEC. SECTION	MANUFACTURER/ DESCRIPTION	REMARKS
		WALL PADS	11 66 00	MFG: Draper COLOR: Navy Blue	
		GYMNASIUM BACKBOARD PADDING	11 66 00	MFG: Draper COLOR: Navy Blue	
		SCOREBOARD - BASKETBALL	11 66 00	MFG: Daktronics FIELD CLR: Navy Blue TRIM CLR: White	
		HORIZONTAL BLINDS	12 21 13	MFG: Hunter Douglas COLOR: 276 Silverado	
		TELESCOPING BLEACHERS	12 66 13	MFG: Hussey Seating COLOR: 289 Dark Blue	

SECTION 10 11 16

MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Framed markerboards and tackboards.

B. Related Requirements:
1. Section 06 10 00 - Rough Carpentry; wood grounds.
2. Section 06 40 00 - Architectural Woodwork, display cases.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Reflectivity: Not to exceed specified range when tested at 60 degrees with a gloss meter in accordance with ASTM C 523.
2. Contrast for marker boards (Light and Dark Effects): not more than 11.7 when tested with a BYK-Gardner Wave Scan 5+ Measurement Device showing visual acuity to the human eye at distances greater than 10 feet.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

B. Product Data: Include complete manufacturer's catalog cuts and data sheets of anchors, fasteners, color chips (photographic reproductions are not acceptable) and installation requirements.

C. Shop Drawings:
1. Include types of units provided, location within each room, and length of each unit.
2. Include dimensioned elevation drawings of each board assembly indicating joint locations and type of joint where required, and board mounting distances from floors.
3. Include cross-section details showing each type of product and components; trim, face, core, backing materials and thickness, and key to elevations.
4. Show anchorage details.
5. Show installation details.

D. Samples: Submit a 12" x 12" sample of each type of markerboard and tackboard. Submit a 6" long sample of each component of exposed trim.

E. Quality Control Submittals:
1. Test Reports: Copies of test reports, from certified testing agency, verifying that products have been tested and meet the specified performance requirements.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Maintenance Data: Include data on regular cleaning, and stain removal.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/smoke rating for vinyl fabric covered tackboards in accordance with ASTM E 84.

B. BYK-Gardner Wavescan 5+

C. Porcelain Enamel Institute (PEI): PEI-1002, Manual and Performance Specifications for Porcelain Enamel Writing Surfaces (Whiteboards).

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 WARRANTY

A. Assembled Units: Manufacturer's standard 1-year warranty against defects in materials and workmanship.

B. Special Warranty for Porcelain-enamel Face Sheets: Manufacturer's standard Life-of-the-building warranty in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship. Failures include, but are not limited to: 1) Surface lose original writing and erasing qualities; 2) Surfaces become slick or shiny; 3) Surfaces exhibit crazing, cracking, or flaking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Liquid Chalk Type Board (MB): Provide projectable porcelain enamel steel liquid chalk writing system, 4'-0" width by length indicated. Product/ manufacturer; one of the following:
LCS^3 White Board; Claridge Products and Equipment, Inc.
Porcelain on Steel Markerboards; Platinum Visual Systems™; a division of abc School Equipment
1. Face sheet of 24 gage leveled enameling steel with porcelain enamel writing surface.
2. Core material of nominal 1/2" thick fiberboard or double-ply hardboard.
3. Panel backing of 0.015" sheet aluminum or 26 gage sheet steel.
4. Manufacturer shall factory assemble and bond together the face sheet, core and backing sheet.
5. Colors shall be as selected by Architect.
6. Markerboard panel shall be up to 16'-0" in length without joints.
7. Provide music staffed boards where indicated.
   a. Staffing shall be fused 1/8" lines, 1" center to center, 5 spaces between staffs, both G and F clefs.
   b. Colors as selected by Architect.
8. 2 Flag Holders for each marker board per classroom

B. Framed Tackboard (TB): Provide vinyl covered tackboards in configuration as shown Product/ manufacturer; one of the following:
Fabricork Vinyl Bulletin Boards; Claridge Products and Equipment, Inc.
Vinyl Corkboard; Platinum Visual Systems™; a division of abc School Equipment
1. Heavy-duty, self-healing vinyl machine laminated under high pressure to 1/4" thick cork.
2. Rigid backing panel of 1/4" hardboard.
3. Cork and backing panel shall be factory assembled and bonded together.
4. Colors shall be as selected by Architect.
5. Tackboards shall be up to 16'-0" in lengths without joints.

C. Frames and Trim: Provide extruded aluminum frames and trim. Finish for exposed trim surfaces shall be Architectural Class II AA-M21A31 natural anodic coating. Snap-on type trim is not acceptable. Product/manufacturer; one of the following:
Series 185; Claridge Products and Equipment, Inc.
HTS; Platinum Visual Systems™; a division of abc School Equipment

D. Joint Strips: H-shaped aluminum in single pieces for full height of boards.
1. At vertical joints within markerboards, color the strips to match the markerboards.
2. At vertical joints between markerboards and tackboards, strips shall be anodized aluminum.

E. Map Rails: 1" wide of extruded aluminum with cork insert and Claridge No. 51ES type end stops. Furnish one No. 51M metal map hook for each linear foot of map rail and two No. 51FH flag holders for each room with map rails. Finish map rail to match the markerboard frames."

F. Adhesive: Flash-proof type furnished or recommended by the manufacturer.

G. Exhibit Rails/Tack Strips: 3" wide extruded aluminum with Fabricork insert (color as selected by Architect) similar to Claridge No. EDR Exhibit Rail.

2.2 FABRICATION

A. Fabricating Boards: Markerboards and tackboards shall be factory framed units up to 16'-0" one piece in length. Boards too large to be factory framed shall be assembled on the job to match the factory-built boards.
   1. Assemble frames with hairline joints. Corner joints shall be mitered. There shall be no exposed face fasteners of any sort.
   2. Make up boards in single sheets without joints where possible. Where vertical joints are necessary, space them symmetrically and use joint strips to cover them. Horizontal joints are not acceptable.
   3. Vertical joints between markerboard and tackboard in the same frame shall be covered with single mullion trim pieces. Double mullions at these joints will not be acceptable.
   4. Provide a map rail across the top of each markerboard unit.
   5. Provide a chalktrough under each markerboard unit. except markerboards at gymnasium/activity/ weight/aerobics rooms
   6. Manufacturer's labels shall not be exposed to view.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify surfaces to receive units are true and plumb. Report unsuitable conditions to the responsible contractor for correction prior to installation.
   2. Verify moisture and temperature levels of substrate and environment have stabilized.

3.2 INSTALLATION

A. Erecting Framed Units: Install framed markerboards and tackboards in conformance with the manufacturer's instructions using continuous wall hangers and adjustable mounting clip angles.
   1. On masonry walls, secure the hangers with screws into metal expansion shields or with toggle bolts.
   2. On gypsum wallboard partitions, locate the hangers to engage the steel stud flanges where possible and secure with molly bolts or self-drilling fasteners into the studs, or attach to wood blocking with suitable length screws.
   3. On back of markerboards, field install blocking pads at 16" on centers horizontally and vertically. Apply manufacturer's recommended adhesive evenly over entire surface of each pad using a serrated trowel.
   4. Behind the tackboards furnish and field install suitable blocking pads 16" o.c. each way to prevent bowing.
   5. Behind pegboards, field install blocking pads at 16" on centers.
   6. The installed boards shall be flat, plumb, square and rigid.
   7. Mounting Height: From finished floor to bottom of chalkrail or bottom of tackboard shall be:
      Kindergarten / Pre-Kindergarten - 24"
      Elementary - 30"
      Intermediate (4th and 5th) - 32"
      Junior High / Middle School - 36"
      Senior High - 36"
      Adult-only Locations - 36"

3.3 CLEANING

A. Remove crates, cartons and rubbish from the premises and leave the rooms broom clean. Clean down board surfaces to leave them in perfect condition.

END OF SECTION

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SECTION 10 14 00

IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast aluminum letters, room identification signs, and building dedication plaque.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Submit manufacturer's complete line of color samples, 1" x 3", for initial color selection.

C. Invoices: Submit certified copies of invoices indicating description and quantity of signs delivered and installed.

D. Template: Submit full-size template drawing for approval of aluminum letter size, stock, spacing, anchorage devices, etc.

1.3 PRE-INSTALLATION CONFERENCE

A. Pre-installation Meeting: Contractor shall schedule a pre-installation meeting at the project site with the Architect, Contractor and building letter installer for approval of template field layout prior to beginning of installation.

1.4 QUALITY ASSURANCE

A. Interior signs shall be provided by a single source with at least five years' experience successfully providing signs of similar type and scope.

B. Signs shall comply with the Texas Accessibility Standards (TAS) and other laws and ordinances of authorities having jurisdiction. Braille shall be Grade II, having dimensions as required to meet TAS.

1.5 PACKING, DELIVERY, AND STORAGE

A. Deliver components correctly packaged to prevent damage. Pack modules and back-up plates unassembled to allow for mechanical mounting of backplate to wall with concealed fasteners.

B. Individually and clearly identify each sign number, type, location to be installed, mounting instructions, and other pertinent information.

1.6 WARRANTY

A. Cast Aluminum Letters: Provide 5-year manufacturer's warranty.

PART 2 - PRODUCTS

2.1 INTERIOR IDENTIFICATION GRAPHICS – OWNER PROVIDED / CONTRACTOR INSTALLED

A. "InTouch" photopolymer plaque signs as manufactured by ASI Sign Systems, Inc. (8181 Jetstar Drive, Suite 100, Irving, Texas, 75063) or approved equivalent.
   1. Manufacture face panels utilizing an 1/8" integral photopolymer panel.
   2. Face panel tactile and Grade 2 Braille graphics shall be raised a minimum of 1/32".
   3. Treat the face panel to assure paint adhesion.
   4. Colors to be selected by Architect to meet ADA requirements for contrast.
   5. Characters and background of signs shall have eggshell, non-glare finish.
   6. Sign edges shall be painted to match background.
   7. Sign edges are to be smooth and free of saw marks and imperfections.

8. Sign design shall be as indicated on drawings.
9. Typeface shall be Helvetica Medium.
10. Lettering shall be computer generated, accurately reproducing the letterform.
11. Provide matching coverplate for signs mounted on glass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Erecting Letters: Erect letters straight and level on the exterior face of building where shown.
   1. Attached to face brick: Secure with threaded stud anchors set in non-staining, quick setting cement. Letters shall be flush mounted to masonry surfaces.
   2. Attached to CMU wall: Secure letters to CMU wall with stainless steel threaded rods and non-staining, quick setting cement. Letters shall be flush mounted to masonry surfaces.
   3. Bottom rail mounting on top of prefabricated aluminum canopy.
      a. Attach continuous aluminum rail to top of aluminum canopy as indicated on the Drawings.
      b. Drill and tap letters from the bottom, with stainless steel screws going through aluminum rails.
      c. Provide a flattened base on letters with round bottoms (O, S, G, etc.) to receive studs.
      d. Include tiebacks as recommended by letter fabricator.

B. Identification Graphics:
   1. On hard surfaces (i.e. ceramic tile, masonry, or plastic laminate), install room identification signs plumb and square with the "Tuff-bond" silicone adhesive furnished by the manufacturer (foam tape is not allowed).
   2. On painted gypsum wallboard or vinyl wallcovering, install room identification signs on backing plates with the "Tuff-bond" silicone adhesive furnished by the manufacturer (foam tape is not allowed).
      a. The backing plate shall be 1/8" thick and shall be the same size as the face panel.
      b. Screw the backing panel into molly bolts in the wall with two countersunk, flathead screws.
   3. Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
   4. Unless noted otherwise, install signs on latch side of the door such that clear floor space of 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
   5. Installation shall comply with ADA requirements.
   6. For signs mounted on glass, install matching coverplate on opposite side of glass and aligned with the sign.

3.2 CLEANING

A. On completion, clean exposed surfaces and leave free of defects.

B. Do not use abrasives.

3.3 COORDINATION

A. Contractor shall coordinate the installation of the identifying devices with other trades involved in the project.

3.4 DAMAGE

A. An identifying device which is scratched or defaced will be rejected.

END OF SECTION

SECTION 10 21 15

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Plastic toilet compartments and urinal screens.

B. Related Sections:
1. Section 05 50 00 - Metal Fabrications: supports for floor-to-ceiling compartments.
2. Section 06 10 00 - Rough Carpentry: wood blocking for bracket attachments.
3. Section 10 28 00 - Toilet Accessories.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. Submit complete manufacturer's catalog cuts and data sheets with installation requirements supplied. Include finish and installation requirements for hardware, anchors and fasteners.
2. Submit literature documenting that the compartment door latch meets Texas Accessibility Standards (TAS) requirements.

C. Shop Drawings: Include drawings for fabrication and erection of toilet compartment assemblies which are not fully described in manufacturer's data.

D. Samples: Submit a sample, 6" x 6", of each plastic finish and color selected. (photographic reproductions of color are not acceptable)

1.3 WARRANTY

A. Submit manufacturer’s standard 15-year warranty against breakage, delamination, and corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide floor-mounted, overhead-braced toilet compartments. Product/manufacturer; one of the following:
Standard HDPE; Scranton Products (Santana/Comtec Ind./Capitol Partitions)
Polly™ HDPE; Metpar Corp.

B. Urinal Screens; product/manufacturer; one of the following;
Wall Mounted Urinal Screens; Scranton Products (Santana/Comtec Ind./Capitol Partitions)
Type WH; Metpar Corp.

2.2 MATERIALS

A. Panels, doors, and pilasters and urinal screens shall be fabricated from High Density Polyethylene (HDPE), not less than 1 inch thick, manufactured under high pressure to form a solid homogeneous sheet with a textured gloss finish. Color(s) shall be as selected by Architect.

B. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel of one-piece construction, 3" high, finish to match hardware.

2.3 FABRICATION

A. Fabricate compartments with all edges machined to a radius of 0.250" with all sharp corners removed. Machine for hardware at the factory. Seal all plastic surfaces with protective film.

B. Fabricate flush compartment panels, pilasters and doors to the layout indicated with the following minimum dimensions.
   1. Where grab bars are indicated, provide a min. 32" wide (clear opening) out-swinging door.
   2. At other locations, standard compartments shall have a 24" wide in-swinging door unless specifically detailed and dimensioned otherwise.
   3. Doors and compartments panels 55" in length with a 14" clearance between floor and bottom of panels and doors. Pilasters shall be floor mounted, overhead braced, 82" high.
   4. Urinal screens 18" by 42" high.

C. Hardware: Provide hardware and fittings for compartment system of chrome-plated cast non-ferrous metal alloy, chrome-plated brass, or polished stainless steel. Stirrup brackets only may be heat-treated extruded aluminum with bright anodized finish.
   1. Hinges: Adjustable to permit doors to be set either self-opening or ajar. Hinges shall be 8" and fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with bright dip anodized finish with wrap-around flanges, through bolted to doors and pilasters with stainless steel, torx head sex bolts.
   2. Latches: Heavy-duty extruded aluminum (6463-T5 alloy) and provision for emergency access and paddle handle on accessible stalls in compliance with the ADA. Latch housing shall have bright dip anodized finish.
   3. Strikes and Keepers: Wrap-around type with rubber bumper, mounted with through bolts.
   4. Coat hooks with rubber bumpers for in-swinging doors.
   5. Pulls: Provide pulls adjacent to the latch on both sides of the toilet partition door. Furnish with wall bumpers where required to prevent doors from striking wall.
   6. Brackets: Heavy duty aluminum (6463-T5 alloy) two-eared stirrup brackets, one-eared brackets at corners. The use of U-type brackets is not acceptable.
   7. Fasteners: Vandal proof (one-way) screws and sex bolts of chrome-plated brass or stainless steel for all exposed locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, soundness of wall surfaces, location of built-in framing/anchorages/bracing, and other conditions that would affect proper installation of holding brackets and anchorage or suspension devices.

B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

3.2 INSTALLATION

A. Install compartments rigid, straight, plumb and with horizontal lines level. Drilling, cutting and fitting to room finish shall be concealed in the finished work. Clearance at vertical edges of doors shall be uniform from top to bottom, and doors shall be free of warp and wind. Provide clearances of not more than ½" between pilasters and panels, and not more than 1" between panels and walls.
   1. Attach dividing compartments to the back wall with two heavy two-eared stirrup brackets, and at the front to the pilasters with two of the same type brackets. Use two one-eared brackets at corners. The use of U-type brackets is not acceptable.
   2. Attach overhead braces to walls with heavy saddle-type brackets.
   3. Attach pilasters to floor with ⅜" threaded studs, washers, lock nuts, expansion shields (minimum of 2" penetration into concrete) and pilaster brackets. Level, plumb and tighten the installation with the leveling device. Set tops of doors level with top of pilasters when doors are in closed position. Conceal the floor anchorage and bases with pilaster shoe assembly having concealed snap-down action on a concealed hold-down clip. Exposed fasteners on shoe will not be permitted.
   4. Provide a 13-1/2" clearance between floor and bottom of compartment panels and doors and pilasters.
   5. Attach urinal screens to the wall with 3 heavy two-eared stirrup brackets. The use of U-type brackets is not acceptable.

3.3 ADJUST AND CLEAN

A. Adjusting: Adjust hardware just prior to final acceptance. Doors shall operate freely.
   1. For out-swinging doors, adjust hinges to hold doors closed.
   2. For in-swinging doors, adjust hinges to hold doors open at 30°.

B. Cleaning: Remove protective masking and clean surfaces, leaving them free of soil and imperfections.

END OF SECTION

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SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Toilet accessories

B. Related Sections:
1. Section 08 80 00 - Glazing: un-framed mirrors.
2. Section 10 21 15 - Plastic Toilet Compartments.

1.2 SUBMITTALS

A. Product Data:
1. Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
3. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

1.3 QUALITY ASSURANCE

A. Products: Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.
1. Stamped names or labels on exposed faces of units will not be permitted.
2. Provide locks where specified, with the same keying for all accessory units in the project.

1.4 COORDINATION

A. Accessibility Standards: Coordinate accessory locations with other work to prevent interference with clearances required for access under Texas Accessibility Standards (TAS), Architectural Barriers Act--Article 9102, Vernon's Texas Civil Statutes and Texas Government Code, Chapter 469.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toilet accessories shall be of the quality manufactured by Bobrick Washroom Equipment, Inc. and are listed by Bobrick catalog numbers for convenience in identification. The use of a catalog number as a description of an item shall be taken to include the description or specification for the item in the manufacturer's catalog.

B. Toilet Accessories: Equivalent items of the following manufacturers are acceptable:
American Specialties, Inc.
Bradley Corp.
General Accessory Manufacturing Co. (GAMCO)
McKinney/Parker Washroom Accessories Corp.

2.2 BASIC MATERIALS

A. Stainless Steel: ASTM A 666, Type 304 with No. 4 satin finish.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30 castings.

C. Sheet Steel: ASTM A 1008, cold rolled, commercial quality.

D. Galvanized Steel Sheet: ASTM A 653, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electro-deposited on base metal.

F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q3, nominal 1/4" thick, with silvering, electroplated copper coating, and protective organic coating complying with ASTM C 1036.

G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

I. Keys: Provide universal keys for access to accessories for servicing and resupplying. Provide minimum of six keys.

2.3 ACCESSORIES

A. Toilet Tissue Dispensers (A-1): 565728 - Tork Twin Bath Tissue Roll Dispenser Black; Owner Provided / Contractor Installed:

B. Toilet Tissue Dispensers (A-2): 565828 – Tork 3 roll Bath Tissue Roll Dispenser – Black; Owner Provided / Contractor Installed:

C. Grab Bars (B): GAMCO Min. 150 Series Owner Provided / Contractor Installed:

D. Mirrors (C): GAMCO “A” Series – ¼” Tempered

E. Paper Towel Dispenser/Waste Receptacles (E1): Model B-3944 multi-fold dispenser

F. Hard Roll Towel Dispenser: Sanitouch 09990; Owner Provided / Contractor Installed:

G. Soap Dispensers, Wall-Mounted (G1): Buckeye International Model # 1.25L Stealth Dispenser –

H. Coat/Robe Hooks (K1): Model B-211.

I. Shower Seat, Folding, L-Shaped (M1): Model B-5181.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers’ written instructions and recommendations, using fasteners appropriate to substrate and recommended by manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated. Adhesive mountings and plastic rawl plug mounts will not be acceptable.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square.

C. At toilets with wheelchair compartments all toilet accessories shall be installed so that operating areas such as coin slots, pushbuttons, openings for towels, cups and waste are not more than 48" above finished floor for frontal approach.

D. Attach dispensers and cabinets to steel stud partitions with suitable hollow wall screw anchors. Attach dispensers and cabinets to masonry partitions with stainless steel expansion shields and machine screws.

E. Attach sanitary napkin disposal units and toilet tissue dispensers to toilet partition panels with stainless steel or chrome plated through bolts and hex cap nuts.

F. Install grab bars to withstand a downward load of at least 250 lbf. Attach grab bars to toilet partition panels with stainless steel through bolts and plated hex cap nuts. Attach grab bars to steel stud partitions with

connector assemblies to steel anchors fastened to studs. Attach grab bars to masonry partitions with stainless steel expansion shields and machine screws.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fire extinguishers and fire extinguisher cabinets.

1.2 DEFINITIONS

A. Where indicated on the drawings the abbreviation "F.E.C." defines a fire extinguisher and cabinet and the abbreviation "F.E." is for fire extinguisher without cabinet.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include physical dimensions, operational features, color and finish, anchorage details, material descriptions and type of hardware.

C. Shop Drawings: Include rough-in measurements, locations, and details for cabinets.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain products in this Section from one manufacturer.

B. Certifications
1. Provide extinguishers which are U.L. listed and bear the U.L. "Listing Work" for type, rating, and classification.
2. Conform to NFPA-10 requirements for extinguishers.
3. Provide units conforming with ANSI/UL 711.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store extinguishers in protected location until after final cleaning is completed.

1.7 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Do not store products subject to freeze damage in environments where damage could occur.

PART 2 - PRODUCTS

Fire Extinguisher Cabinet Manufacturer’s do not manufacture fire extinguishers. They use fire extinguisher’s manufactured by Amerex, Buckeye, etc and re-label them with their own label.

2.1 FIRE EXTINGUISHERS

A. Provide multi-purpose dry chemical type fire extinguisher, 10 lbs. nominal capacity. Provide manufacturer's standard hook type bracket where fire extinguishers are noted without cabinets. Product/manufacturer; one of the following:
   Cosmic 10E; J.L. Industries, Div. of Activar, Inc.
   MP10; Larsen's Manufacturing Co.
   Wing 10HB; Modern Metal Products
   Model 3010; Potter-Roemer

2.2 FIRE EXTINGUISHER CABINETS

A. Provide steel trim and door. Doors shall be solid with vertical window and have continuous piano hinge. “Fire Extinguisher” vertical ascending silk-screened lettering in red. Product/manufacturer; one of the following:
   Fire-FX 1017V10 Ambassador; J.L. Industries, Div. of Activar, Inc.
   FS 2409-R4 Vertical Duo, Acrylic; Larsen’s Manufacturing Co.
   “Alta” Series No. 7023-DV-6; Potter-Roemer.

B. Recessed solid flush panel door with vertical ascending silk screened lettering, no stick-on lettering, cold rolled steel with electrostatically applied, thermally fused polyester coating with recoatable white finish. Standard chrome plated handle with roller catch. Size as required by size of fire extinguisher furnished for project. Provide appropriate mounting brackets and signage.
   “Embassy” Series No. 5614S21; J.L. Industries, Div. of Activar, Inc.
   “Occult” Series No. O-2409; Larsen’s Manufacturing Co.
   “100" Series No. 1026R1; Modern Metal Products, Div. of Technico, Inc.
   “Dana” Series No. 7220 F-VAB; Potter-Roemer

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer’s standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for type and capacity of fire extinguisher indicated, with plated or baked-enamel finish. Color shall be red.

B. Identification: Identify bracket-mounted fire extinguishers with the words “FIRE EXTINGUISHER” in red letter decals applied to mounting surface. Orientation shall be horizontal.

2.4 FABRICATION

A. Form body of cabinet with tight inside corners and seams.

B. Predrill holes for anchorage.

C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.

D. Hinge doors for 180° opening with continuous piano hinge. Provide nylon roller type catch.

2.5 FINISHES

A. Extinguisher: Red enamel.

B. Cabinet Trim and Door: Primed.

C. Cabinet Interior: White enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fire extinguisher cabinets at locations indicated in accordance with the manufacturer's instructions. Install level, plumb, secure. Install fire extinguisher cabinets with operable part of extinguisher at 48" above finished floor.

B. Install fire extinguishers within cabinets on mounting brackets, placed in such a manner that operating instructions face outward.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb. Apply identification decals above bracket-mounted fire extinguishers.

D. Service, charge (if required), and tag each fire extinguisher not more than five calendar days prior to substantial completion.

E. Maintain design of fire-rated partitions associated with cabinets.

END OF SECTION

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SECTION 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal lockers and locker benches.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete; concrete in base.
2. Section 04 20 00 - Unit Masonry; Concrete masonry unit bases.
3. Section 06 10 00 - Rough Carpentry; wood sleepers and wood blocking.
4. Section 06 40 00 - Architectural Woodwork; wood benches.
5. Section 09 65 00 - Resilient Flooring; rubber base.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit complete manufacturer's catalog cuts and data sheets of hardware, anchors, fasteners and installation requirements.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show base sloping tops filler panels and other accessories. Include locker identification system.

D. Samples: Submit color chips (photographic reproductions of color are not acceptable).

1.3 QUALITY ASSURANCE

A. Uniformity: Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

B. Store and protect lockers under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

C. Protect locker finishes and adjacent surfaces from damage during installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Athletic Lockers: Materials and methods described are based on the specifications of List Industries, Inc. (www.listindustries.com) and are given to designate the quality of materials and workmanship required. Equivalent lockers as manufactured by one of the following will be acceptable:
DeBourgh (www.all-american-lockers.com)
Lyon Metal Products, Inc. (www.lyonmetal.com)
Penco (www.pencoproducts.com)

2.2 ATHLETIC LOCKERS

A. Provide all welded construction athletic lockers. Nuts, bolts, screws, and pop-rivets will not be allowed.
   1. Doors: 14 ga. diamond perforated, 16 ga welded joints for sides, top, bottom and shelves, 18 ga. for backs and 20 ga. For ends / filler panels, 1" double bends on both sides and single ⅞" bend at top and bottom. All welded and ventilated. Latch hooks shall be located directly across from hinges.
   2. Vertical dividers: ¾" 13 ga. flattened expanded metal framed by 16 ga. hollow "T" sections designed to conceal sharp edges of divider with entire assembly mig welded. Dividers shall have channel bracing at the bottom forming a rigid frame for each locker unit.
   3. Provide double-tier lockers as indicated.

B. Locks:
   1. Recessed handle with:
      a. Provisions for Owner-furnished padlocks.

C. Trim: 16 gage steel filler strips to cover spaces between lockers and adjacent walls at ends of rows and elsewhere as may be required. Provide finished end panels for exposed ends of locker rows. Finish shall match lockers.

D. Equipment: Furnish each locker with the following items.
   1. Double-tier Lockers:
      a. One double prong hook and not less than two single-prong wall hooks.

E. Continuous Sloping Tops: Not less than 16-gage sheet steel, approximately 25° pitch, in lengths as long as possible. Provide closures at ends. Finish to match exterior of lockers.

F. Finish: Chemically pre-treat metal with degreasing and phosphatizing process. Apply baked-on enamel finish to all surfaces, exposed and concealed, except plates and non-ferrous metal. Custom colors shall be selected by Architect. Interior, exterior, and all parts of locker shall be the same color.

G. Number Plates: Aluminum with black filled numbers, fastened with rivets to the top of the front face of the locker, not in the recess. Number lockers consecutively as directed by Owner.

H. Acceptable Products: All-Welded Team Room Athletic Lockers and All-Welded Gym Lockers by List Industries, Inc.
   1. Type A Locker: Double-tier, 18"W x 18"D x 30" Tall with continuous sloping top, concrete base and recessed handle with provisions for Owner-furnished padlocks.
   2. Type B Locker: Single height, 12"W x 12"D x 72" Tall with continuous sloping tops, concrete base and recessed handle with built-in combination lock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases and verify that bases are properly sized and located. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

B. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36" o.c. The use of sheet metal screws for assembly and installation is not allowed.

C. Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

D. Install benches in compliance with manufacturer's instructions.

3.3 ADJUST AND CLEAN

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint.

C. Touch-up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

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SECTION 10 73 26

PREFABRICATED WALKWAY COVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Prefabricated walkway canopies. and wall-mounted suspended canopies

B. Related Requirements:
1. Section 03 30 00 - Cast-in-place Concrete.
2. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Include drawings showing small scale layouts of prefabricated walkway canopies and large-scale details of edge conditions, joints, expansion joints, anchorages, trim, closures, and special details.

C. Samples: Submit two 12" square samples of finished metal panels.

D. Certification: Submit design calculations sealed and signed by an engineer registered in the State of Texas. Design calculations shall state that the protective cover system design complies with the wind requirements of all governing jurisdictions, the stability criteria of applicable building code, and all other governing criteria.

1.3 QUALITY ASSURANCE

A. Wind Loading: Fabricate and install prefabricated walkway canopies and other components of system to comply with code requirements for resisting wind effects based on a 120 mph wind.

B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the canopy manufacturer and has completed installation of canopies similar in material, design, and extent to canopy required for this project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide prefabricated walkway canopies as manufactured by one of the following:
AVAdek
Dittmer Architectural Aluminum
Mapes Industries, Inc.

2.2 MATERIALS

A. Aluminum Sheets: Extruded aluminum sections, Alloy 6063, T6 temper.

B. Structural Supports: Extruded aluminum sections, Alloy 6063, T6 temper.

C. Fasteners: Manufacturer's standard non-corrosive types, with heads gasketed.

D. Accessories: Provide components required for a complete prefabricated walkway canopy system, including fascia, trim, closures, clips, fillers, and similar items. Match materials and finishes of prefabricated walkway canopy framing.

2.3 FABRICATION

A. General: Fabricate and finish canopies and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and dimensional requirements. Internal gutters shall connect to weep system.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to receive prefabricated walkway canopies for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General: Comply with canopy fabricator's and material manufacturer's instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor supports and other components of the work securely in place, with provisions for thermal and structural movement. Install expansion joints to provide for thermal and structural movement.

3.3 CLEANING AND PROTECTION

A. Damaged Units: Replace canopies and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning: Upon completion of canopy installation, clean finished surfaces as recommended by canopy manufacturer, and maintain in a clean condition during construction.

END OF SECTION

SECTION 11 31 00

APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Appliances.

B. Related Sections:
1. Section 12 32 16 - Manufactured Plastic-laminate-clad Casework
2. Division 22 - Plumbing: plumbing rough-in.
3. Division 26 - Electrical: electrical rough-in.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data: Include list of optional features, operating characteristics, and dimensions of individual appliances.

C. Operating and Maintenance Manuals: Provide per SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

D. Shop Drawings: Submit rough-in drawings showing dimensioned locations of electrical and plumbing stub-outs for appliances.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Provide electrical components required as part of appliances that are listed and labeled by UL and that comply with applicable NEMA standards.

B. Accessibility Standards: Where appliances are required to comply with accessibility requirements, comply with Texas Accessibility Standards (TAS).

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Commercial Washer Extractor: Provide Model Softmount SY55 as manufactured by Speed Queen.

B. Commercial Drying Tumbler: Provide Model OPL Drying Tumbler 75lb gas model as manufactured by Speed Queen."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions.

3.3 CLEANING AND PROTECTION

A. Test each item of appliances to verify proper operation. Make necessary adjustments. Verify that accessories required have been furnished and installed.

B. Remove packing material and leave units in clean condition, ready for operation.

C. Protection: Protect the completed work from damage.

END OF SECTION

SECTION 11 65 10

SCORING DISPLAY SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work under this Contract includes all installation labor, materials, tools, transportation services, supervision, coordination, etc., necessary to complete the design/build installation of the Scoring Display Systems, as described in these specifications and illustrated on the associated drawings. The systems shall be called the “Scoring Display Systems” and the installer the “Scoring Display System Installer”.

B. The work specified herein is performance based. This requires the Installer to provide all subsequent design and engineering, which is not included within the Contract Documents, to meet the requirements of this Performance Specification. The drawings included with this specification convey system concepts. The plans do not necessarily show complete and accurate building details. The Installer is responsible for making field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems.

C. Work includes a number of separate scoring/advertising/naming displays. Drawings should be considered to be conceptual in nature, illustrating the features and appearance of the system. The Scoreboard Installer shall assume full responsibility for final structural engineering, mechanical requirements as well as construction information and coordination required in accordance with the Installer's final design of elements being provided under this contract.

D. The Scoring Systems include supply and installation of the following major items:
1. Two (2) main court basketball scoring displays
2. Secondary steel for attachments to building are in this installer’s scope of work.
3. Scoring control components, including software.
4. Low voltage control system for all displays, and any illumination for advertising panels, etc. to be included as part of this contract to allow control of lighting and displays from that location.
5. All electrical distribution/load centers, etc., to each display system from each installation point from isolator or disconnect as shown on electrical drawings
6. Option pricing.
7. Operations and maintenance training.

E. The Contract also includes:
1. Provision of final engineering, development of final design drawings and submission to the Owner and Architect for approval.
2. Submission of all information required by public agencies.
3. All necessary construction and sign permits.
4. Registered Engineers’ stamp on drawings and calculations required.
5. Verification of dimensions and conditions at the job site.
6. Coordination with other contractors and trades.
7. Preparation of submittal information.
8. Installation and all anchorages and attachments in accordance with the contract documents, manufacturer’s recommendations, and all applicable code requirements.
9. Initial tests and adjustments, written report, and documentation.
10. Instruction of operating personnel; provision of manuals.
11. Maintenance services; warranty.
12. Provision of court/floor protection if using any crane or mechanical lift when installing and servicing displays.

F. The Contract Documents are complementary and are intended to include or imply all items required for the proper execution and completion of the work. Any item of work required by the Specifications or other portion of the Contract Documents, but not shown on the drawings, or shown on the drawings but not required in the Specification, shall be provided without extra charge as if shown or mentioned in both.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI)

B. American National Safety Institute (ANSI)

C. American Society of Mechanical Engineers (ASME)

D. American Society of Testing and Materials (ASTM)

E. National Electrical Manufacturer's Association (NEMA)

F. Occupational Safety and Health Administration (OHSA)

G. Underwriters Laboratories (UL)

H. United States Institute of Theatre Technology (USITT)

I. Entertainment Services and Technology Association (ESTA)

J. Standard for Electric Signs, UL-48, 13th Edition

K. Standard for Control Centers for Changing Message Type Signs, UL-1433, 1st Edition

L. Federal Communications Commission Regulation Part 15

M. National Electric Code (NEC)

1.3 DESCRIPTION OF WORK

A. Connect (provide all required cabling and transmission electronics) Scoreboards to court control locations as indicated on drawings. Control components will be portable with the capability of connecting at a courtside location.

B. Work includes (2) basketball scoring displays. These displays will be fixed digit LED scoring technology with options for advertising/naming displays and necessary computer controlled scoring systems. Scoring Systems consist of:
   1. Secondary structure and supplemental steel to attach displays and enclosures to building's walls as located on the drawings.
   2. Coordination with Construction Manager, Structural Engineer and Architect as to final scoreboard design and locations.
   3. Fixed Digit game-in-progress displays:
      a. LED colors: as directed by Owner
      b. Display assembly color: as directed by Owner
   4. Option for advertising/naming panels with four color copy (artwork provided by Owner)
   5. Wired scoring controllers

C. Low voltage, signal raceway/conduit from the courtside control locations to the scoring display locations and to the scoring equipment rack location will be provided by the project. Any additional conduit/raceway required for a code compliant, complete installation (no bare cabling is allowed in locations exposed to public view) is to be included in this scope of work.

D. Supply complete dimensions, clearance requirements, mounting locations and requirements, and total and point load structural loading data.

E. Provide fixture data for any illuminated displays. Provide manufacturer's minimum operation life expectancies for any light bulbs and illumination devices.

F. Provide all ventilation and climate control equipment, including shop drawings, dimensions, clearance requirements, unit weights and noise data.

G. Structure and Enclosure:
   1. Design, document, furnish and install all required structure, enclosures and support for scoreboard and displays. All supplemental steel, girts and framing required to provide a complete enclosure shall be furnished and designed in accordance with the project Miscellaneous Metals Specification Section, but provided under this contract. Attachment and structure shall also be provided for any siding enclosure, border trim panels, face closeout, bezel, etc. Contractor shall submit drawings and calculations showing all structural attachments between display and structure for review by the project Structural Engineer. Submittals shall be in accordance with the provisions in this specification as well as related specification sections.
   2. Contractor is responsible for touch up and repairs of welds, paint and finishes where work attaches to structure. Coordinate with Owner to maintain all product warranties where attaching to other trades such as Paint, Roofing, Expansion Joints, etc.
   3. Color of all exposed structure, enclosures, close-out panels, etc. to be determined during the submittal process. Submit color samples to Owner for approval.
      a. NOTE: Identify costs associated with changing structure, display or assembly color at time of proposal.

H. Supply complete assemblies (supplemental structure, enclosure, and finish) for displays to attach to building's walls as appropriate, including structural engineer (registered in the jurisdiction of the project) stamped calculations.

I. Control Equipment
   1. Connections between displays and control equipment and any physically separate control position locations shall be included in this installer's scope of work.
   2. All control equipment for scoring and clock displays to have the ability to be connected at courtside locations.
   3. Scoring software and controller functions/overlays are required for the following sports:
      a. Basketball
      b. Volleyball
   4. Displays to be able to be independently turned on and off from the courtside location. Displays to have individual on/off control include:
      a. Scoring Displays
      b. Any ad panel illumination

J. Display and scoring cable runs to be composed of a minimum of 2 discrete bundles.

K. Coordinate with Owner's Testing and Inspection Agency to provide access for testing of welds and attachments in accordance with the project General Conditions and overall project requirements and specifications. All testing criteria shall be as indicated in the project General Conditions and overall project requirements and specifications.

L. Supply and install processors and/or controllers in a rack located in the court storage area of both practice courts and not within display enclosures.

1.4 RESPONSIBILITY AND RELEATED WORK

A. Supply accessories and minor equipment items needed for complete systems, even if not specifically mentioned herein or on the drawings, without claim for additional payment.

B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Scoring System Installer to supply systems in full working order. Notify the Owner's Representative of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings will be provided without claim for additional payment.

C. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner.

D. If a conflict develops between the contract documents and the appropriate codes and is reported to the Owner's Representative prior to bid opening, the Owner's Representative will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

E. Electrical
   1. Power is provided at locations shown on electrical drawings. The Installer shall be responsible for termination and distribution electrical power from the transformers and panel boards to the equipment as required (including load center, breakers, step down transformers, etc.). This will include necessary distribution boards, conduit and cabling as required for a complete installation.
   2. A ground point will be provided for each display. The Installer shall be responsible for connecting existing/Owner provided ground point to all equipment in accordance with NEC code, local codes and standards specified herein.
   3. Refer to electrical single line diagrams for minimum short ratings of all required equipment.

F. Coordinate work with other trades to avoid causing delays in construction schedule.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: At least 5 years of experience in the production of specified products or as approved by the Owner.

B. Installer's Qualifications information to be provided with Bid Response. Firm experienced in the installation of systems similar in complexity to those required for this project; and meet the following:
   1. At least five years of experience with equipment and systems of the specified types.
   2. Experience with at least two comparable scale new construction projects within the last three years.
   3. Maintain a fully staffed and equipped service facility.
   4. With the bid return, the potential Installer shall demonstrate that he has:
      a. Adequate plant and equipment to complete the work.
      b. Scoring software appropriate for NFHS, NCAA Division 1 basketball games
      c. Adequate staff with commensurate technical experience.
      d. Suitable financial status to meet the obligations of the work.

e. References from three (3) or more users of similar display and software control systems provided by Installer.
f. List of subcontractors intended to do the work.
g. Provide with bid, the name and relevant experience of the proposed project manager. Also provide the name and qualifications of the site superintendent.

C. With proposal, provide listing with appropriate explanation regarding the status of Manufacturer's or Installer's resolved or unresolved legal disputes within the last six calendar years.
1. With proposal, provide listing with appropriate explanation regarding any projects within the last 3 years, where the Installer or Manufacturer has failed to meet construction schedules, due Installer or Manufacturer’s cause.

1.6 SUBMITTALS

A. Submit all shop drawings and submittals in accordance with project requirements. Quantities listed herein are the minimum required of this contractor.

B. Shop drawings and submittal data shall contain sufficient information to describe the Work to be performed. Drawings shall be executed at an appropriate scale. Refer to Division 1 for submittal requirements. Submit all Shop Drawing information at one time. Information shall include but not necessarily be limited to:
1. Elevation and Sections of all displays along with enclosure/structure fabrication drawings.
2. Any internally Illuminated Advertising Panel detailed drawings.
3. Finishes of all exposed housings.
4. Wiring diagrams. Complete, detailed wiring diagrams for all systems, based on the contract documents but including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring in conduit.
5. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.
6. A material list of all equipment to be furnished, arranged in specification order. This list shall be followed by catalog data sheets, arranged in specification order, of all equipment to be furnished. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol. This submittal must be submitted in its entirety.
7. Floor Plan drawings showing exact locations of devices and equipment.
8. Floor Plan drawings showing exact power requirements and conduit routing for each system with the location of all junction boxes.
9. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Indicate welded connections using standard AWS welding symbols.
10. Submit a letter of certification prepared by a professional Structural Engineer(s) (registered in the State of Texas) employed by the fabricator certifying the following:
a. The aforementioned Engineer is fully experienced in the design of structural steel (primary or secondary) and signage.
b. All shop drawings (including all supports, connections and components) shall be prepared under the direction of the aforementioned engineer(s), in compliance with the Contract Document requirements and applicable building codes. His seal and signature shall appear on all shop drawings. The aforementioned shop drawings shall include sufficient information to enable the Architect to confirm that design loads, support points and tie backs are in compliance with the Architect's design criteria.
c. This certification letter must be received by the Architect and Owner prior to the submission of the Shop Drawings, and shall bear the seal and signature of the aforementioned engineer.
11. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, design loads, support points and tie backs.
12. The design shall be in accordance with the aesthetic design intent of the project with the Architect having final authority in reference to aesthetic matters.
13. All design calculations (which shall bear the seal and signature of the aforementioned engineer) indicating compliance with the requirements of the design criteria and appropriate codes shall be provided to the Architect prior to fabrication for record purposes.
14. The calculations provided to the Architect at project completion shall be forwarded to the Owner as part of “Project Closeout”.
15. Proposed cable labeling technique.
16. Samples as required in various specification paragraphs.
17. Power consumption at 50%, 75% and 100% illumination levels (all lighting elements energized) for each display.
18. Drawings of initial proposal for pre-programmed displays
19. Description of QA/QC procedure.

C. Training and Event Attendance Submittals:
   1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
   2. Following discussions with Owner, formally submit a Training and Event Attendance submittal 2-4 weeks prior to first training. Submittal shall:
      a. Include a separate page/entry for every training session.
      b. Indicate date, time, and approximate length of training session.
      c. Indicate person(s) conducting training.
      d. Indicate whether training will be video recorded.
      e. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
      f. Include signature and title lines for
         1) Owner acknowledging and accepting training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
         2) Countersigning by trainer indicating that training actually occurred.
         3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
         4) Owner's representative attending training at the end of the session shall initial that:
            a) Training Occurred.
            b) Training Materials were provided and left with owner
            c) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
            d) Training was generally sufficient for the proposed curriculum.
      g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)
   3. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

D. Final Inspection Notification Report. Two copies of a typed, neatly prepared checkout report for each piece of equipment and the entire system shall be prepared and submitted; it shall include:
   1. A complete listing of every piece of equipment including serial number, the date it was tested and by whom, the results and date re-tested (if failure occurred during any previous tests).
   2. The final report shall indicate that every device tested successfully.
   3. A performance test report indicating that the system meets all of the Installer testing requirements of Part III.

E. Contract closeout submittals:
   1. Keep a complete set of drawings on the job, note any changes made during installation, and submit one corrected set of reproducible drawings showing Work as installed.
   2. Submit the following data for review, prepared as indicated, at least one week prior to acceptance testing (exceptions noted):
      a. System Reference Manual: Electronic copies.
         1) System Operation and Instructions. Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity. This procedure should describe the operation of all system capabilities. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
         2) A list of all equipment, indicating manufacturer, model, serial number, and equipment location (i.e.; rack/room number). Update following acceptance testing, if changed.
         3) Manufacturer's Instruction Manuals for all items of equipment, incorporating or followed by manufacturer's warranty statements.
         4) Where manufacturer registration is required, register warranty in Owner's name, and at an address determined by Owner. Provide copy of registration.
         5) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
         6) A list of settings, if applicable, of all semi-fixed controls. Update following acceptance testing.
         7) Photographically reproduced schematic wiring diagrams of the scoreboard and advertising display low and high voltage systems, based on the as-built documentation, at a reduced scale easy to handle but fully legible. Blueline (or similar diazo process) prints are not acceptable.
         8) Maintenance Instructions, including Installer's maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products. Instructions shall include

recommendations for products and cleaning, washing and painting of all matrix, auxiliary, and advertising boards for a period of 10 years as deemed necessary by the Owner or tenant.

9) A legend of acronyms and abbreviations must accompany all documentation.
10) Any other pertinent data generated during the Project or required for future service.
11) Manufacturer's Service Manuals and parts lists for all equipment. Photocopies are not acceptable. For custom circuits or modifications, complete schematics and parts lists.
12) As-built wiring diagrams and system block diagrams showing nominal input and output levels. (Submit within two weeks after Acceptance Testing.)
13) Duplicate copies of reduced-scale wiring diagrams.
14) Photographically reproduced as-built wiring diagrams and overall building wiring diagrams, at a reduced scale easy to handle but fully legible. Blueline (or similar diazo process) prints are not acceptable. Mounted behind clear acetate and located with the equipment racks.

F. Submittal format:
1. Provide a unique control number in consecutive order (e.g. 11 63 10-001)
2. Provide a complete table of contents with the following information:
3. Project title and number
4. Submittal number. In the case of a re-submittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
5. Date of submission.
6. Referenced addendum or change order number as applicable.
7. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
8. Index by manufacturer and model or part number unless specified otherwise herein.
9. Each submission page stamped with Display System Installer's certification stamp, initialed or signed certifying:
10. Review, approval and acceptance of submission.
11. Certification of product compliance to specification.
12. Verification product may be incorporated within the work.
13. Arrange product data list in specification order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer's data sheets, arranged in the same order. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
14. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'–0".
15. Provide electronic copies as required of drawings and other Project Record information as dictated in the General Conditions.

G. Resubmission Requirements:
1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate any changes that have been made other than those requested.

1.7 PROJECT CONDITIONS

A. Verify all conditions on the jobsite applicable to this work. Notify Owner's Representative in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The drawings diagrammatically show cables, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Owner's Representative for approval, showing how the work may be installed.

C. This installer is responsible for all additional electrical (high and low voltage), structural, mechanical and plumbing work for completed systems.

1.8 ACCEPTANCE TESTING

A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Owner's Representative or Owner's Consultant.

B. Provide one person familiar with all aspects of the system to assist the Owner's Representative or Owner during acceptance testing. One of the available individuals must have specialized knowledge of the control system.

C. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

D. Final Acceptance shall occur after the displays have functioned without failure for two games/events (as defined by the Owner).

1. Failure shall be defined as a failure of the display, or a portion of the display, to meet the project performance specifications for a length of time greater than one minute due to electronic, electrical, mechanical, structural, or other failure of the display. Failure due to owner's operators, spectators, or force majeur will not be considered event failure; failure due to installer's operators will be considered a failure.

1.9 DISPLAY AND SCORING SYSTEMS SOFTWARE LICENSE

A. Introduction
1. All proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor shall agree that 3rd party (e.g. manufacturer's) proprietary software provided with the system shall be subject to this agreement.
3. Contractor and owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership
1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the owner.
2. Except as expressly set forth in this paragraph, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modification and Use
1. Source code shall be available to owner for a period of not less than 15 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right in owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.
5. During the life of the system (defined as a period of not less than 10 years and not more than 15 years), the Contractor shall provide software updates in accordance with all necessary support requirements to maintain the system. This shall include a commitment to provide appropriate patches, fixes, and interface updates as necessary to maintain the operability and security of the system at a level commensurate with the original system.
    a. In the event that computer and or processor hard ware refinements and updates are necessary to support software updates 7 years after substantial completion, said hardware will be provided to owner at the agreed upon terms for change orders of the original contract.
    b. Labor shall be in accordance with change order rates of the original contract, as adjusted for inflation in accordance with project General Conditions.
6. All hardware supplied shall support software updates for a period of not less than 7 years following substantial completion.

1.10 WARRANTY/MAINTENANCE

A. Warrant labor and materials for (2) two years following the date of the first event, or Final Acceptance by Owner, whichever is later. This is to be from the date of acceptance of the equipment.

B. System to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or materials within the Warranty period without charge.
   1. A defect as it applies to a pixel shall be at any point that the pixel fails to be able to meet the performance requirements of this specification.
   2. A defect as it applies to the score and clock controller.

C. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

D. Within the warranty period, answer service calls within 8 hours, and correct the problem within twenty four hours.

E. Register all manufacturer's warranties in Owner's name.

F. Maintain spare parts inventory on-site as listed in this specification from end of initial warranty period through year 5 of display life. Within 72 hours of notification that spare part has been used, that part (excluding bulbs) shall be replaced by the service representative/manufacturer.

G. During the 100,000 hour nominal LED display lifetime, the Owner may have certified brightness and measurements made on scoreboard(s) according to the acceptance procedure to verify that the board is operating within specifications. If the board is not capable of meeting specifications, provide price perform the necessary repair and component replacement to bring the system to operational parameters. This new work shall be warranted for 20,000 hours effective from the original Owner acceptance date.

1.11 OPTIONS, ALLOWANCE AND UNIT PRICING

A. Option 11 65 00 – A. Cost to provide one static, unlit, ad panel with four color copy to the top or bottom of each main court display.

B. Option 11 65 00 – B. Cost to provide vinyl team name lettering in lieu of base bid electronic team and player name lettering. Indicate deduct amount.

C. Option 11 65 00 – C. Cost to provide wireless controllers in lieu of base bid wired controllers at the court control location. Coordinate location of antennae, coordinate frequencies of controllers for optimal operation without disrupting operation of other frequencies in use in the area.

D. Option 11 65 00 – D. Cost to provide two (2) LED goal scoring strips on the main north and south basketball goals.
   1. Light Strips
   2. Lines perimeter of backboard
   3. Programmable
   4. Standard of quality:
      a. Daktronics BB-2135
      b. Nevco
      c. OES
      d. Translux
      e. As approved

E. Option 11 65 00 – E. Provide incremental cost to remove all Shot Clock Displays.

F. Voluntary alternate/option. If there is a procedure or task that is adding significant cost to each bidder's proposal, then identify the item and the savings for eliminating the item.

PART 2 - PRODUCTS

2.1 SPECIFIED PRODUCTS AND MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of quality. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer's specifications. Verify performance as required. Where two or more acceptable products are listed, the Installer may use either at his option. Invitation to bid does not necessary imply that vendor has met all qualification requirements.

B. Suppliers invited to bid are done so with no implication or certification that their proposed products meet the technical requirements of this specification. Potential vendors are invited to prepare prices for more than one display type meeting these specifications. Suppliers invited to bid include:
   1. Scoring Fixed Digit Displays
      a. Daktronics
      b. OES
      c. Trans Lux
      d. Nevco
      e. As approved by Owner
   2. Scoring Equipment
      a. Daktronics
      b. OES
      c. Trans Lux
      d. Nevco
      e. As approved by Owner

C. Other qualified manufacturers will be considered subject to approval of technical data, samples, and results of independent testing laboratory tests (if necessary to verify performance) of proposed equipment, submitted in accordance with project requirements.
   1. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
   2. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

D. All equipment supplied shall be new and meet the latest published specifications of that product. In the event that the product is enhanced, or improved, supply the newer product at no additional cost.
   1. If product is discontinued or becomes obsolete due to continuing product development, replace it with manufacturers' current equivalent at time of installation at no additional cost.
   2. If product is discontinued or becomes obsolete due to technology change, substitution will be based on fair market value of accepted and proposed products, upon approval of substitution by Owner's Representative.

E. While service contract costs form the basis for alternates, the annual costs for a parts-only service contract cannot exceed 6.5% of the base bid price for this section of work. The specifics of the parts only costs are outlined in the description of the service contract.

F. Manufacturer's name, logo, or representation shall not be visible to the public.

G. All materials shall fully comply with Underwriters Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.

2.2 PHYSICAL DESIGN CRITERIA

A. General: Engineer systems to the most stringent applicable code.

B. Seismic Loads: Subject to the Building Official's approval, seismic design shall be under the Building Code in use at the time of the construction of the display

C. Minimum thicknesses, gauges and standards:
   1. All sheet metal shall have a minimum thickness of 18 gauge.
   2. Structural steel members shall have a minimum flange, web or wall thickness of 1/4 inch.
   3. Where similar connections and members are used in other areas of the facility, every effort shall be made to detail and furnish members in a consistent and uniform manner.

D. Enclosure and structure.
   1. All display enclosures, all additional structure, lighting, power distribution, convenience outlets, and other items for installation, operation, maintenance, and repair is this contractor's responsibility.
   2. Installer to submit complete drawings showing the connection of the Installer supplied equipment to the building structure at each different condition.
   3. Installer to submit design calculations, bearing structural engineer's stamp for review. Review will be for design intent only and shall not be construed as approving the design analysis.
   4. The scoreboard structure, supports, attachment and anchoring members, mounting hardware shall be provided in accordance with engineering standards and governing codes.
   5. Exposed steel and coatings to be in accordance with project paint and coating specifications.
   6. Enclosure.
      a. Enclosure to be shop fabricated, anodized aluminum. Color to be determined with Owner. Construction to comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other industry standard practice.

b. Form exposed sheet metal work without excessive “oil-canning”, buckling and tool marks with exposed edges folded back to form hem. Finish to comply with NAAMM “Metal Finishes Manual” for finish designations and application recommendations. For components which are assembled or welded in factory, apply finish after completion of fabrication.
c. Electrolytic protection shall be provided wherever differing metals come into contact.
d. Trim shall be coordinated to be identical in appearance to adjacent advertising panels (whether provided herein, or by others).
e. Finishes shall match adjacent existing elements, unless otherwise indicated.
f. All welds shall be cleaned, primed and painted.
g. Cabinet depth of adjacent scoring and advertising/naming rights displays shall be within 1” (+/-). Notify Owner when variance is greater.

E. Modules and displays to be serviced from front.

F. Electrical
1. Provide complete power and branch circuit distribution within the enclosure from the existing demarcation point as shown on electrical drawing.
a. Power Distribution: All panel boards or load centers provided with lighting units for power distribution to displays loads shall incorporate main breakers.
2. Conceal conduit and distribution
3. Provide lockable load center, breaker panels, and disconnects. Provide minimum of 4 keys per lock.
4. All materials shall fully comply with Underwriters’ Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.

G. Ventilation
1. Provide natural or forced ventilation as required for operation of all components.
2. Provide all necessary dust and dirt filtration for the ventilation system.
3. Filters shall be easily removable and changeable.
4. NC level attributed to this ventilation shall be no more than NC 40 at nearest seat.

H. Service Requirements
1. All screws and nuts that are required to be removed for access to displays shall incorporate captive screw and nut type designs.
2. A minimum of one of any specialized or custom tool required for maintenance of the display; including any specialized/custom ladder, bosun's chair, or scaffolding required to service displays for maintenance and repair.

I. Provide primary and backup connection from each display to control system locations.

2.3 FIXED DIGIT SCORING DISPLAY

A. Court Scoreboard No. 1
1. Ability to display game in progress information
2. Ability to display overall team scores, game time, period and possession information
3. Team Indicators
4. Monochrome LED lamp matrix; 8 character (minimum)
a. Minimum font height 8 inches
b. 25mm maximum resolution
c. Clock and Score Digits
1) 7 segment bar digits with lens monochrome LED
2) Minimum digit height 10 inches
5. Clock and Score
a. Digits
1) 7 segment bar digits with lens monochrome LED
2) Minimum digit height 10 inches
6. Period, possession, Information, Fouls, T.O.L
a. Digits
1) 7 segment bar digits with lens monochrome LED
2) Minimum digit height 7 inches
7. Ability to score multiple sports
8. Horn with automatic and manual trigger when clock runs to zero
9. Standard of Quality:
a. Daktronics BB-2107
b. OES 5600
1) NOTE: Assembly color to be determined in submittal process and coordinated with architect

2) NOTE: LED color to be determined in submittal process and coordinated with architect.

B. Court Scoreboard No. 2
1. Ability to display game in progress information
2. Clock and Score
a. Digits
1) 7 segment bar digits with lens monochrome LED
2) Minimum digit height 10 inches
3. Period, possession, Fouls, T.O.L
a. Digits
1) 7 segment bar digits with lens monochrome LED
2) Minimum digit height 7 inches
4. Ability to score multiple sports
5. Horn with automatic and manual trigger when clock runs to zero
6. Standard of Quality:
a. Daktronics BB-2101
b. OES 5240
1) NOTE: Assembly color to be determined in submittal process and coordinated with architect.
2) NOTE: LED color to be determined in submittal process and coordinated with architect.

2.4 GAME IN PROGRESS CONTROLLERS

A. General Configuration
1. On/Off control
2. Brightness Control
3. Dedicated wired scoring/clock/statistics (time/clock, score, etc.) control consoles for use court side. Provide for each scoreboard plus 2 spares.
4. Game scoring and clock functions to be controlled, when necessary, from dedicated (non-desktop computer based) control console.
5. One controller to be capable of controlling multiple displays.
6. Statistics module shall support:
a. Basketball
b. Volleyball
7. All control system software and messages shall be stored in non-volatile (disk) format.
8. Back-up computing and redundancy
a. All game scoring functions (e.g. scoring computers, control panels, etc.) shall be completely backed-up with redundant equipment (not necessarily full-time, on-line).
9. Overlays/Inserts
10. Battery back up
11. Carrying case

2.5 SHOT CLOCK DISPLAYS
1. Single Sided Shot Clocks
2. Ability to display 1/10 of a second
3. Display requirements
a. Game Time
1) Seven segment bar digits
2) Minimum height 7”
b. Shot Clock Time
1) Seven segment bar digits
2) Minimum height 13”
4. Mount to Owner supplied basketball goal assembly backboards
5. One set of two, (top of goal only) for main playing court
6. Conceal wiring and distribution units in assembly
7. Standard of quality
a. Daktronics 2130
b. OES
c. As approved

2.6 SCORING DISPLAY SUPPORT EQUIPMENT (IF REQUIRED)

A. A. Equipment Rack to match those being used for the video production equipment and be frame and panel type constructed of 16-gauge cold-rolled steel. - to have locking rear door mounted on the frame (not the

rails). Coordinate location and equipment/cabling in racks with Owner and video production system installer. Empty mounting panel spaces to be filled with blank or vent panels, in a finish to match rack. Provide end panels and top panels as required. Provide shelving as required for equipment mounting within racks. Provide rack supports as required. Provide seven rack keys of each type. Rack color to be gloss or flat black. Provide a magnetically attached, demountable, 60-watt fluorescent or LED lamp in a locally switchable fixture mounted in the top rear of each rack. Include extra set of mounting rails in each rack for rear support of panels or equipment. Verify exact rack space required.

1. Support Equipment
    a. Blank Panels
    b. Vent Panels
    c. Miscellaneous equipment shelving
    d. Rack screws—Middle Atlantic HS
    e. Power distribution
    f. Rack light
    g. Seismic bracing and bases for attachment of racks to structure as required by code.
2. Display System Racks to be:
    a. Middle Atlantic MRK-4431
        1) With side and top panels

2.7 CONTROL CABLING

A. Installation shall include all required and operationally necessary low voltage control and/or fiber optic cabling for all scoring displays from Scoreboard Control location to each display assembly as appropriate.

B. All cable whether fiber optic or copper will be run in conduit/cable tray from the Scoreboard Control location at courtside locations to the equipment rack and to each scoring element. Provide a single spare for each transceiver (line driver) type used by the scoring system.

C. Provide back-up to any cabling sufficient to maintain game in progress clock functions/displays. Provide one spare cable of each type to each display. It is not acceptable to use spare pairs within the same cable.
    1. Include electronics, patch panels, and/or jackfields required at Scoreboard and courtside locations to accept and easily switch to backup cabling without changing cables at the rear of equipment.

D. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment and materials shall be new. Take care during installation to prevent scratches, dents, chips, etc.

B. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least three. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.

C. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommets.

D. AC Power and Grounding
    1. Adhere to all local and national electrical codes and standards.
    2. Label power distribution equipment (e.g. breaker panels, disconnects, and load centers) as to what portion of what module is being served by that device or which advertising panel (e.g. breaker).

E. All engraving shall be 1/8" block sans serif characters unless noted otherwise. On dark panels or push buttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored push buttons, letters shall be black.

F. Equipment and Cable Labeling
    1. Provide engraved lamicoid labels on the front and rear of active equipment mounted in racks. Mount labels in a neat, plumb and permanent manner. Embossed labels are not acceptable. Equipment labels to have at least three lines of engraving with the first line listing the general name of the device. The second line to include the schematic reference of the device. The bottom line to indicate what other devices or areas this equipment controls.
    2. Provide an engraved label over each user-operated control that describes the function or purpose of the control. Label size to be adjusted to fit available space.
    3. Engraved labels to have 1/8" high characters minimum. Labels to be black with white characters except where indicated.

4. Cables, and wiring to be logically, legibly and permanently labeled for easy identification. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style label. Hand-written or self-laminating type labels are not acceptable.
5. Wiring designations to be an alphanumeric code that is unique for each cable. Locate the cable designation at the start and end of each cable run and within 3" of the point of termination or connection. For cable runs that have intermediate splice points, the cable shall have the same designation throughout with an additional suffix to indicate each segment of the run. Actual cable designation assignments to be determined by Installer. Add cable designation codes to system schematic drawings included with Project Record Drawings.
6. Label each terminal strip with a unique identification code in addition to a numerical label for each terminal. Show terminal strip codes on system schematic drawings included with Project Record Drawings.
7. Provide adhesive labels on the rear of equipment where cables attach to indicate the designation of the cable connected at that point. Neatly lace vertical and horizontal wiring inside rack with lacing bars. Horizontal wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Neatly bundle excess AC power cable from rack mounted equipment with plastic cable ties. Rack wiring to be bundled with plastic cable ties or lacing twine. Electrical tape and adhesive backed cable tie anchors are not acceptable. Flush cut cable ties as to prevent sharp, jagged edges.
8. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.

3.2 INSTALLER TESTS AND ADJUSTMENTS

A. Verify the following before actual tests and adjustments on the system:
   1. Electronic devices are properly grounded.
   2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
   3. Insulation and shrink tubing are present where required.
   4. Dust, debris, solder splatter, etc. is removed.
   5. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

B. Preparation for Acceptance, prior to final inspection:
   1. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.
   2. All systems, equipment and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
   3. All materials shall be neat, clean and unmarred and parts securely attached.
   4. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. shall be replaced or properly repaired, and debris cleaned up and discarded.
   5. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed.
   6. All as built documentation, record drawings, operations and maintenance manuals, and test data must be presented prior to or during acceptance as determined by Owner’s representative.
   7. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed.
   8. Verify each individual component is operating properly
   9. Verify each individual component’s performance meets the manufacturer’s published performance for this unit.
   10. Verify proper operation from controlling devices to controlled devices.
   11. Verify proper adjustment, balance and alignment of equipment for optimum quality and to meet the manufacturer’s published specifications.
   12. Establish and mark normal settings for each level control, and appropriately record these settings within the “System Operation and Maintenance Manual.”
   13. Verify that all communications and networking services are installed and in proper working condition (Ethernet, IP addressing)

3.3 TEST EQUIPMENT

A. Provide test equipment and complete, installed control system for final acceptance testing. Test equipment to be available for the entire period through final system acceptance. Prior to start of testing, provide a list to the Owner’s Consultant of test equipment make and model numbers that will be used.
   1. Multimeter: Measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10 ma to 10A.

3.4 ACCEPTANCE

A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owner's Consultant.

B. Acceptance testing will include operation of each major system and any other components deemed necessary. Installer will assist in this testing and provide any test equipment required specified herein. Installer shall provide at least 1 technician available for the entire testing period (day and/or night), to assist in tests, adjustments, and final modifications. Tools and material required to make any necessary repairs, corrections, or adjustments shall be furnished by the Installer. Testing process is estimated to take a one day for all.

C. The following procedures will be performed on each System:
   1. Control functions shall be checked for proper operation, from controlling devices to controlled devices.
   2. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each adjustable control with small white, adhesive dots, and record these settings, in the "System Operation and Maintenance Manual."
      a. For physical controls, normal settings shall be marked with small white, adhesive dots.
      b. For software controls, "screen shots" of the relevant menus, pages or dialog boxes shall be made. Additionally software presets shall be recorded to "disc" permitting full recall.
   3. Installed and loose equipment will be inventoried for correct quantity.
   4. Any other test on any piece of equipment or system deemed appropriate.
   5. Verification of pixel functionality

D. In the event the need for further adjustment or work becomes evident during setup and/or acceptance testing, the Installer will continue his work until the system is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Installer will pay for additional time and expenses of the Owner's Representative.

E. The Owner's Consultant's fees and costs involved in acceptance testing are not the responsibility of the Scoring System Installer, except as described in Part 3 of this specification.

F. Final acceptance will follow the successful control system operation at the completion of the first two practices or other events as defined by Owner.
   1. Tests to be performed in accordance with manufacturer's installation and service manual on displays installed at the site. Tests on display elements or modules prior to installation are not acceptable.
   2. Test report shall include full documentation on test procedure, instruments employed (including model number and serial number) and copy of instrument calibration certification.

3.5 DEMONSTRATIONS

A. Provide 2 hours total instruction to Owner designated personnel on the use and operation of the Systems, scheduled by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative and Owner.

B. Training Schedules
   1. Training should be assumed to take place on the project site, unless agreed to by the Owner.
   2. Training should be scheduled to be non-overlapping, unless agreed to by the Owner.
   3. Actual training schedule shall be by agreement with Owner.
   4. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time.

C. The following is a general idea of the training "curriculum":
   1. A general familiarization of the devices.
   2. An explanation of how the device interfaces to the rest of the system (including data connections; timing requirements and the like).
   3. General training on operating the device.
   4. Specific training on device operation (e.g. entering statistics; how to access data retrieval sources; how to create repeatable formats and layouts, changing fonts, loading new fonts).
   5. Basic and specific troubleshooting
   6. Maintenance procedures

END OF SECTION

SECTION 11 66 00

ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

Section Includes: Athletic equipment.

Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: volleyball sleeves.
2. Section 09 64 53 - Resilient Wood Flooring System.
3. Division 26: Electrical: electrical rough-in for backstop motors and scoreboards.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data: Include manufacturer's specifications, anchor details and installation instructions for products. Shop Drawings: Include drawings for fabrication and erection of equipment assemblies which are not fully described in manufacturer's data.

1.3 QUALITY ASSURANCE

The entire backstop structure shall conform to the current FIBA/NCAA rules and regulations governing basketball in force at time of installation.

1.4 WARRANTY

Provide Manufacturer’s Lifetime Warranty against breakage of backboard.

PART 2 - PRODUCTS

2.1 BASKETBALL BACKSTOPS

A. Backstops: Provide backstops, goals, and nets as manufactured by Draper, Inc. (phone 800.989.0131 web site: www.draperinc.com/Athletic.htm).

1. Type A:
   a. Backstop: Model EZ Fold TF-20J with Goal Brace, ceiling-suspended, forward-folding, rear-braced.
   b. Padding: Padding: 5032XX bolt-on backboard padding kit, color as selected by Architect from manufacturer’s 12 available colors
   c. Goal: EZ Fold 503576 breakaway basketball goal with white nylon anti-whip net.
   d. Height Adjuster, Manual: No. 503092.
   e. Motorized: No. 503085 motorized winch, 1 HP winch, instantly reversing, 115v single phase electric torque motor with EZ Fold 503029 Posilok Safety Belt.
   f. Mounting: Furnish all framing, accessories and associated hardware for a complete and rigid installation.

2.2 GYMNASIUM WALL PADDING

A. Wall pads shall be as manufactured by Draper, Inc.. Panels shall be 2'-0" wide by 6'-0" high constructed of 2" polyurethane foam bonded to 7/16" thick waferboard and covered with 14 oz. vinyl covering fabric folded and stapled securely to wood backer. A 1" nailing margin shall be provided at top and bottom for securing panels to the wall. Provide manufacturer’s optional Vonar interlining material.

1. Color Selection: Navy. Reference COLOR SCHEDULE 09 99 00
2. Approved Alternate Manufacturers:
   a. Porter
   b. AALCO Manufacturing

2.3 VOLLEYBALL SLEEVES

A. Provide Senoh Model KA25 Floorplate/Sleeve volleyball sleeves as manufactured by Sports Imports (phone 800.556.3198 web site: www.sportsimports.com), NO SUBSTITUTIONS. Install sleeve and adapter per manufacturer's written instructions and recommendations.

2.4 DIVIDER CURTAIN

A. Approved Manufacturers
   1. Draper, Inc., (765) 987-7999.
   2. Porter Divider Curtains (217) 367-8438
   3. Manufacturers of equivalent products submitted and approved in accordance with Section 01 62 00 – Project Options.
      a. Type: Electrically operated, roll-up gymnasium divider including motor, belts, controls, clamps for attachment to building structure, threaded rod supports, and other components required for complete functional installation; Roll-Up Gym Divider as manufactured by Draper, Inc.
      b. Operation: Curtain rolled up and down by belts wound onto overhead rotating drive pipe operated by electrical motor.
      c. Roll-Up Gym Divider can be custom fabricated to any size but cannot be cut out for bleachers or other objects. It is recommended that space be provided for people to walk around ends of divider.
      d. Configuration: Rectangular shape with straight bottom and extending across room as indicated on Drawings.
      e. Maximum dimension of stored divider: 2 feet from bottom of structural support to bottom of rolled curtain.
      f. Minimum required clearance between vertical curtain edges and adjacent fixed objects: 6 inches
      g. Provide 36 inches space between curtain ends and walls or fixed objects to allow passage space around divider.
      h. Operating mechanism: Drive pipe winch powered with 3/4 HP, 110VAC, 60-cycle, single-phase, reversible capacitor, C-Face motor with thermal overload protection. Winch assembly shall carry a five-year warranty. Provide with load holding worm gear reduction and integral limit switches to control curtain travel. Drive pipe shall rotate in pipe support assemblies spaced at approximately 9 feet.
      i. Attachment: Attach to structural support with beam clamps, hanger brackets, and 1/2 inch diameter threaded rods. Attachment clamps designed to be capable of supporting a minimum of 5,000 lbs. each and provided in sufficient number to provide a combined minimum 45:1 attachment point safety factor.
      j. Hoist belts: 5 inches wide white polyester webbing attached to drive pipe, passing under bottom batten, and terminating at top batten. Space belts at approximately 15 feet.
   4. Curtain Fabrication:
      a. Upper Curtain Mesh, Woven fabric of 100% polyester yarn coated with PVC.
      b. Lower Curtain, Solid, Woven polyester coated with PVC
      c. Fused seams and the following
         1) Top Hem: Reinforced with double thickness mesh for continuous pipe batten
         2) Bottom Hem: Floor length curtain with hems above finished floor and with standard 4 inch roll up tube and lifting tape
      d. Remote control station key operated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install athletic equipment and accessories in accord with the manufacturer's written instructions and recommendations.
   1. Locate equipment accurately and install to be rigid and secure.
   2. Install supplementary framing required for proper supporting of the backstops.
   3. Mount backstops at proper height.
   4. Paint portion of exterior backstop post below grade (in concrete footing) with heavy bituminous paint.
   5. Set post accurately and plumb, hold in position until concrete is placed.
   6. In addition to securing wall pads at top and bottom at nail strip, apply manufacturer recommended adhesive to back of pads to prevent them from bowing.
   7. Upright sleeves must be absolutely plumb so that upright posts do not lean.
   8. Volleyball Sleeves: Install sleeve and adapter per manufacturer's written instructions and recommendations. Floor plates shall finish flush with the finish court floor surface.

3.2 ADJUSTING

A. Adjust movable athletic equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

B. Set backstop height adjusters to the height directed by Owner or Architect.

3.3 CLEANING AND PROTECTION

A. After completing athletic equipment installation, inspect components. Remove spots, dirt, and debris and tough up damaged shop-applied finishes according to manufacturer's written instructions.

B. Provide final protection and maintain conditions acceptable to manufacturer and installer that ensure athletic equipment is without damage or deterioration at time of substantial completion.

C. Replace athletic equipment and finishes that cannot be cleaned and repaired, in a manner acceptable to Architect, before time of substantial completion.

END OF SECTION

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SECTION 12 21 13

HORIZONTAL BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Horizontal blinds.

B. Related Sections:
1. Section 08 11 00 - Hollow Metal Doors and Frames; glazed openings.
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.
3. Section 08 44 13 - Glazed Aluminum Curtain Walls.

1.2 SYSTEM DESCRIPTION

A. Horizontal metal slat louver blinds installed at storefront, curtain wall, glazed openings, and mirrors manual control of raising and lowering by cord; blade angle adjustable by control wand. Horizontal blinds shall be indicated as "HB" on the drawings.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include manufacturer's catalog cuts and data sheets, and installation instructions and data certifying blinds are lead-free.

C. Shop Drawings: Include details of attachment and schedule of each size and location.

1.4 QUALITY ASSURANCE

A. Measurements: Provide custom size blinds for the openings or mirrors in which they are to be installed. Take careful measurements of each opening so that the blinds will fit properly. Plan dimensions shall not be used. Verify head, jamb, and sill conditions.

B. All blinds shall be lead-free.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Deliver blinds wrapped and crated in a manner to prevent damage to components or marring of surfaces.

C. Store and protect products under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

D. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Horizontal Blinds: 1" wide by 0.0085" thick slat type, with valance for each blind. Product/manufacturer; one of the following:
Bali Classics Mini Blinds; Springs Window Fashions Division, Inc.
Levolor 1" (25mm) Riviera Classic Blind; Levolor Corp.

2.2 MATERIALS AND FABRICATION

A. Horizontal Blinds:
1. Head channel shall be 0.025" thick Tomized steel with a plastic type coating. Channel shall be "U" shaped, approximately 1" high be 1-9/16" wide, with flanged edges at the top.
2. Slat supports shall be braided of polyester yarn. The vertical component shall have a diameter of not less than 0.045" nor greater than 0.066". Braiding shall be accurate to hold slats equally spaced, parallel and straight, and to assure proper tilt control and adequate overlay of slats. Provide 31 rungs per 2 feet of ladder, equally spaced. Distance between ladders shall not exceed 21". The horizontal component shall consist of not less than four cables interbraided with the vertical component.
3. Slats shall be virgin aluminum alloy approximately 1" wide by 0.0085" thick. Slats shall have sufficient crown to prevent sagging and radius corners.
4. Bottom rail shall be 0.023" thick Tomized steel with a plastic type coating.
5. Tilter shall be Tomized steel of enclosed construction. Unit shall tilt the slats to any desired angle and hold them at that angle. An automatic disengagement of worm and gear shall eliminate overdrive to prevent strain or damage to wand, worm, gear, ladder or top slat. Operation shall be by wand of sufficient length and swivel for easy operation.
6. Lift cord shall be of adequate diameter, braided of high strength synthetic fibers.
7. Finish: The factory finish for the exposed surfaces shall be a plastic type finish coat baked on. Color shall be as selected by Architect from manufacturer's standard color range.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive blinds for conditions which will adversely affect the installation of the blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Attach installation end brackets at each end of blind location. For blinds over 55" long or over 50 square feet in area, provide intermediate brackets.
1. At door installations, provide hold down brackets to hold bottom rail securely to door.

B. Blinds shall be mounted in brackets inside frame jambs by skilled mechanics under the supervision of an authorized representative of the manufacturer. The completed blinds shall be left clean and in perfect working order. Crates, cartons, and rubbish shall be removed from the premises; rooms shall be left broom clean.

3.3 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4".

B. Maximum Offset From Level: 1/8".

3.4 ADJUSTING

A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Adjust blinds for smooth operation.

3.5 CLEANING

A. Clean work under provisions of SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic laminate-faced casework as shown on drawings.
2. The fabrication and installation of standard casework components of base cabinets, wall cabinets, storage cabinets, wardrobe cabinets, shelf units and other units as indicated.
3. The fabrication and installation of custom units, as detailed in the drawings.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry; blocking.
2. Section 09 65 00 - Resilient Flooring; coved rubber base.
3. Section 10 21 14 - Plastic Laminate Toilet Compartments
4. Section 22 40 00 - Plumbing Fixtures

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions for each type of casework unit.

B. Samples: Submit 6" x 6" samples of specified finishes, including top material. Samples will be reviewed by Architect for color, texture and pattern only. Compliance with other specified requirements is exclusive responsibility of contractor.

C. Shop Drawings:
1. Submit shop drawings for plastic laminate-faced casework showing plans, elevations, ends and cross-sections. Show details and location of anchorages and fitting to floors, walls and base. Include layout of units with relation to surrounding walls, doors, windows and other building components.
2. Coordinate shop drawings with other work involved.

D. Mock-up Casework:
1. Submit one full-size sample of finished base cabinet unit complete with hardware, doors and drawers, without finish top.
2. Submit one full-size sample of finished wall-mounted cabinet unit complete with hardware, doors and adjustable shelves.
3. Furnish both hinged and rolling door samples.
4. Acceptable sample units will be used for comparison inspections at project. Unless otherwise directed, acceptable sample units may be incorporated in work. Notify Architect of their exact locations. If not incorporated in work, retain acceptable sample units in building until completion of work and remove sample units from premises when directed by Architect.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Provide casework with tops and accessories manufactured or furnished by same casework company for single responsibility.

B. Catalog Standards:
1. The use of catalog numbers and specific requirements set forth in drawings and specifications, are not intended to preclude the use of other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction and workmanship.
2. Custom units shall be of the same quality as standard units specified.

C. AWI Quality Standard: Comply with grades of interior architectural woodwork, construction, finishes and other requirements of the “Architectural Woodwork Standards”, 2nd Edition, 2014, adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), except as otherwise indicated.
   1. Use Premium Grade, except use Economy Grade for millwork in custodian closets and storage rooms. Items not given a specific quality grade shall be Premium Grade.

D. Color Uniformity: Provide plastic laminate for laminate-clad casework, plastic faced wood doors and plastic laminate toilet compartments from the same manufacturer.

E. Manufacturer shall have at least 5 years’ experience and have done installations for similar types of projects.

F. Accessibility Standards: The following special requirements shall be met, where required to comply with Texas Accessibility Standards (TAS).
   1. Countertop height with or without cabinet below, not to exceed a height required by TAS.
   2. Kneespace clearance to be minimum clearance as required by TAS.
   3. 12" deep shelving, adjustable or fixed not to exceed a range as required by TAS.
   4. Wardrobe cabinets to be furnished with rod/shelf adjustable to 48" A.F.F. at a maximum 21" shelf depth.
   5. Sink cabinet clearances as required by TAS.
   6. Cabinet locks, latches, and other operating mechanisms shall be mounted to comply with forward reach requirements of TAS; i.e. 15" to 48" above finish floor, except locked bottom drawers at base cabinets.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver plastic laminate-faced casework only after wet operations in building are completed.

B. Store completed plastic laminate-faced casework in a ventilated place, protected from the weather, with relative humidity therein of 50% or less at 70°F.

C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering. Woodwork damaged through neglect of the above requirements shall be repaired or replaced without additional cost to the Owner.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Install finish carpentry products only when temperature and humidity conditions have been stabilized and will be maintained.

B. Maintain temperature and moisture conditions as recommended by woodwork fabricator from date of installation through remainder of construction period.

1.6 GUARANTEE

A. Provide 5-year guarantee against defective materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Manufacturer's catalog numbers for Case Systems, Inc. (website: www.casesystems.com, phone 989-496-9510) are shown on drawings and included in specifications for convenience in identifying certain cabinet work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet, hardware, or equipment.

B. Subject to compliance with requirements of this specification, equivalent plastic laminate-faced casework as manufactured by one of the following will be acceptable:
   CIC Concepts in Cabinetry
   Jericho Woodworks
   Jim R. Reynolds & Assoc.
   Stevens Industries

2.2 GENERAL

A. Decorative laminate casework shall be Case Systems as specified or approved equal with the following minimum features:
   1. M-3 47# density engineered particleboard for cabinet components meeting or exceeding all requirements as set by ANSI A208.1-2009.
   2. PVC edges applied with hot melt.
   3. Epoxy coated, self closing, minimum 150# static rated drawer slides with lifetime warranty.
   4. Non-Racking, Non-Deflecting Platform Drawer Box With 1/2" Thick Bottoms.
   5. 1/2" Thick Cabinet Back.
   6. "Balanced" High pressure laminates applied with rigid PVA glue.
   7. Thermally Fused Laminate Interior, excluding backs of doors and drawers, complying with requirements of NEMA LD3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
   8. Each Cabinet to have a factory applied, separate and full support toe base construction.
   9. Colors and finishes shall be as selected by Architect.
   10. Casework shall be independently tested to meet the following minimum performance values:

Base Unit Racking	1460 lbf
Base Front Joint Loading	725 lbf
Wall Unit Racking	1600 lbf
Wall Unit Static Load	2500 lbf
Drawer Unit Static Load	1050 lbf
Drawer Front Joint Load	805 lbf
Drawer Side Joint Load	450 lbf

   11. Rail mounted casework shall be vertically and horizontally adjustable.
   12. Rail mounted casework shall have integral lower leveling bar, adjustable from inside of cabinet.

B. Color and finish selections: Architect reserves the right to select one color for the exposed surfaces of the basic components of cabinets and a different color for the following components of cabinets: door and drawer fronts (including edges of door and drawer fronts), backs of open shelving and countertop and backsplash, unless shown otherwise.

2.3 MATERIALS

A. Exterior Vertical Surfaces:
   1. Door and drawer fronts and backs, finished end panels, and exposed exterior backs shall be surfaced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.
   2. Exterior vertical high-pressure laminate panels shall be balanced with textured .020" thick high-pressure cabinet liner conforming to NEMA Standard LD3-1995. Color as selected by Architect. Surface texture shall be similar to exterior finish.
   3. High-pressure laminate must be laminated using a PVA adhesive, set under pressure, resulting in a rigid glue line. Contact adhesives shall not be used.
   4. HPDL at open interiors, underside of wall cabinet bottoms, interiors of glazed door cabinets shall be considered exposed and finished in Decorative High-Pressure VGS laminate.

B. Plastic Laminate: General purpose grade, high pressure decorative laminate meeting requirements of NEMA LD 3. Colors shall be as selected by Architect from full color, finish and pattern range of plastic laminate manufacturers listed. Product/manufacturer; one of the following:
   Formica Brand Laminate; Formica Corp.
   Nevamar or Pionite Decorative Laminate; Panolam Industries.
   Wilsonart; Wilsonart LLC.

C. Thermally Fused Interiors at Semi-Exposed Surfaces: Interior surfaces behind doors, drawer boxes, backs, and unfinished ends shall be laminated with a thermally fused laminate that meets or exceeds the performance standards for NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Panels shall be of "BALANCED" construction. Fast cycle thermally fused, melamine foil or polyester surfaced panels or other surface types that do not meet these requirements are not acceptable. This excludes backs of doors and drawers, which shall be balanced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.

D. 3mm PVC Edges: Door and drawer edging shall be 3mm PVC. The PVC shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Hand tool applying and trimming of PVC shall not be allowed. Edging shall be available in TWENTY TWO coordinated color options.

E. Particleboard:
   1. Particleboard shall be Grade M-3 Industrial, according to the American National Standard (ANSI) for Mat-Formed Wood Particleboard, ANSI-A208.1-1993 and shall meet or exceed the following:
      a. Density 47 lbs/cu.ft.
      b. Moisture Content 6%
      c. Modulus of Rupture 2400 psi
      d. Modulus of Elasticity 450,000 psi
      e. Internal Bond 80 psi
      f. Hardness 900 pounds
      g. Linear Expansion 0.30%
      h. Thickness Tolerance +/- 0.005”
      i. Face Screw Holding 325 pounds
      j. Edge Screw Holding 275 pounds

2.4 CASEWORK HARDWARE AND ACCESSORIES

A. Provide manufacturer's standard, satin finish hardware units, unless otherwise indicated.

B. Hinges: Concealed hinges of heavy gauge metal construction, with hinge manufacturer’s lifetime warranty. 170° swing. Hinge shall have six-way adjustment. Doors to be self-closing, and fitted with silencer bumpers. Provide HH050 concealed hinge.

C. Wire Pulls: Solid brass with duel chrome finish, 4" wide, for drawers and swing doors, mounted with two screws fastened from back. Provide two pulls for drawers over 24" wide.

D. Door Catches:
   1. Dual self-aligning, heavy-duty permanent magnet type with resistance in compliance with the Americans with Disabilities Act and Texas Accessibility Standards. Provide two catches on doors over 4' high. At double-leaf doors, provide Ives No. 2 catch for leaf with the lock. Four screws per catch.
   2. At double-leaf doors, provide Ives No. 2 catch for leaf without the lock. Four screws per catch.
   3. At each 1-1/8” doors, provide 1 flap stay No. 499.050.02.0215 or 499.050.03.0215 (Mepla) or approved equivalent.

E. Drawer Slides and Accessories:
   1. Standard Drawers: Case DS230, self-closing design, epoxy powder coated with positive in-stop. Captive nylon rollers, front and rear. Minimum 100 lb. load rating.
   2. File Drawers: Case DS430, full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
   3. File Drawer Rails: Case FR010, file drawer box shall have full height sides supporting the plastic file rails for hanging file folders.
   4. Paper Storage Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.

F. Drawer and Cabinet Locks: Provide National Lock No. C8053-14A, half-mortise type, disc tumbler locks, round cylinder only exposed. Locks to be keyed differently, with locks in individual rooms keyed alike. Provide a masterkey.

G. Cabinet Base Molding: To be provided by General Contractor in field.

H. Adjustable Shelf Supports: Provide twin pin design with anti tip-up shelf restraints for both ¾" and 1" shelves. Design to include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating to be minimum 300 lbs. each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection. Product/manufacturer; one of the following, no substitutions:
   1. SC240 Plastic Shelf Clip; Case Systems, Inc.
   2. Clear Polycarbonate Shelf Clip; TMI System Design Corp.

I. Shelf and Rod Hardware:
   1 hanger rod KV660SS
   1 shelf and rod support KV1195
   2 rod flanges KV734
   wood dowel connectors

J. Countertop Support Bracket: Case Systems, Inc. Model X0670
   1. 11 gauge construction
   2. Powder-coated finish in color as selected by Architect.
   3. Load rating of 200 lbs. per lineal foot.

2.5 CONSTRUCTION

A. Cabinet body components shall be secured utilizing concealed interlocking mechanical fasteners as approved by the “Architectural Woodwork Standards”, 2nd Edition, October 1, 2014, as adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), Section 10 and Appendix A. They shall be especially designed for use in joining particleboard panels.

B. Joints are tight fitting and will not rupture or loosen due to the following:
   1. Dimensional changes in the particleboard.
   2. Racking of casework during shipment and installation.
   3. Normal use.
   4. Fastening devices and screws shall be treated to deter or resist corrosion.

C. Construction Features:
   1. Structural components shall be 3/4” thick with balanced surfaces.
   2. Back panels shall be 1/2” thick surfaced both sides for balanced construction.
   3. Drawer components shall be 1/2” thick surfaced both sides for balanced construction.
   4. Mounting stretchers are 3/4” thick structural components fastened to end panels by mechanical fasteners, and are concealed by the cabinet back.
   5. Maintain a 1/8" max. reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
   6. When the rear of cabinets are exposed, a finished 3/4” thick decorative laminate back panel is applied.
   7. Exterior grade plywood core individual bases, factory applied to base and tall cabinets shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall. Also to conceal the top edge of applied vinyl base molding. There shall be a front to back center support for bases over 30” wide.
   8. Horizontal parting rails between drawers shall be 3/4” particleboard with balanced surfaces, secured to and further reinforcing cabinet ends. When drawers are keyed individually within a cabinet, or when drawers are fitted with lock hasps, the parting rail shall run full depth of cabinet to prevent pilfer.
   9. A 5mm diameter row hole pattern 32mm (1-1/4”) on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.
   10. Door and drawer fronts and finished ends shall be balanced construction with “high-pressure” laminate bonded to both sides of a M-3, 47# particleboard core.
   11. Doors over 24" wide or 80" high shall be 1" thick.
   12. Adjustable shelves shall be particleboard core, balanced surfaces and have a .020” thick PVC front edge. Per AWI, shelving shall not deflect in excess of 1/4" when loaded.
      a. Adjustable shelves behind doors, 3/4" thick to 27" wide, over 30” wide shall be 1” thick min.
      b. Adjustable shelves in open cabinets shall be 1” thick, except for special use cabinets such as mail, cubical or locker type units.
      c. There shall be no play in adjustable shelves 1/16" each end, max.
   13. Fixed Interior Components such as fixed shelves, dividers, and cubicle compartments shall be full 3/4” thick particleboard attached with concealed interlocking mechanical fasteners.

D. Wall Cabinets:
   1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
   2. Wall cabinet bottoms shall be of 1” thick particleboard core mechanically fastened to end panels and secured to the bottom back stretcher.
   3. An upper 3/4" thick stretcher shall be located behind the back panel with two interlocking mechanical fasteners per end. Also the stretcher is secured to the cabinet top with #8 x 2” plated flat head screws.
   4. A lower 3/4” thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. The stretcher is also secured to the cabinet bottom.

E. Base Cabinets:
   1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.

2. Base cabinets, except sink cabinets, shall have a solid 3/4" thick sub-top fastened to the ends with interlocking mechanical fasteners.
3. Each kneespace to have apron with dimensions per drawings.
4. Provide 1-1/2" thick dividers between kneespaces and adjacent spaces (e.g. dishwasher openings, other kneespaces, etc.)
5. Sink cabinets shall have a vertically mounted front stretcher panel supporting the countertop, a split removable back panel, and four steel corner gussets used to secure the counter-top.
6. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
7. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.

F. Tall Cabinets:
1. Each end panel to be secured with a minimum of eleven interlocking mechanical fasteners for a total tensile strength of 3,850 pounds.
2. An intermediate fixed shelf shall be provided on general storage cabinets to maintain internal dimensional stability under heavy loading conditions.
3. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
4. An intermediate 3/4" thick stretcher shall be located behind the back panel and be secured to the cabinet ends with interlocking mechanical fasteners. Where an intermediate shelf is present, the stretcher shall also be secured to the shelf with a #8 x 2 plated flat head screw.
5. Drawers with 1/4" bottoms requiring hot melt glue or intermediate supports will not be permitted. No exceptions will be permitted.
6. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.

G. Drawers:
1. Drawer box shall be constructed with a full 1/2" thick non-racking, non-deflecting platform bottom which is carried directly by "L" shaped, bottom mount drawer glides. Sides are secured with 1 1/4" long screws directly into platform and into the sides.
2. Sides, back, sub-front and bottom shall be 1/2" thick 47# density particleboard surfaced both faces with Light Beige, Greystone, or White thermally fused laminate per 2.02.B.1. The top edge shall be .020" PVC matching the drawer color.
3. Corners shall be joined with fluted hardwood dowels and glue, minimum 32mm o/c.
4. Drawer fronts shall be removable and attached drawer box sub-front with screws from inside of drawer.

2.6 PERFORMANCE

A. Laminates:
1. "High Pressure Laminates" shall meet the definition and performance requirements of NEMA LD3-1995. Vertical grade laminate shall be VGS (0.028") balanced with a VGS. Countertops shall be HGS (0.048").
2. Thermally Fused Laminate shall meet the performance requirements of NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Cabinet manufacturer shall submit panel manufacturers' current published specification stating ANSI core properties and NEMA finish properties.

B. Hinges: ANSI 156.9.4.1,2,3,4: Two hinges mounted 23" on center on a 23-7/16" wide x 19-11/16" high cabinet door shall be capable of supporting a 100 pound test load located 1" from the outside edge of the door.
1. Cycle, open and close, from 5 degrees open through 95 degrees open with no failure to hinges, door, or cabinet end panel. The maximum horizontal permanent hinge set shall not exceed .030".

C. Drawers: ANSI/BHMA A156.9-1988 4.11: an actual production drawer box with an applied finished front and 450mm drawer slides mounted per the manufacturers' instructions shall be tested as follows:
1. Dynamic Cycle Test: When uniformly loaded with 100 pounds and tested through 50,000 opening and closing cycles, the drawer shall operate freely.
2. Static Edge Load Test: When the drawer is fully extended, a 150 pound load shall be supplied to the drawer front at a point on the centerline of the drawer for one minute. No permanent damage or distortion shall occur.

D. Adjustable Cabinet Shelving: Shelving shall not deflect in excess of 1/4” when loaded with calculations per AWI Standards.

2.7 COUNTERTOPS

A. High-Pressure Decorative Laminate, Nominal 1 1/8” Thick Countertop:
1. General Purpose, HGS (0.048”) high-pressure decorative laminate on horizontal surface, conforming to NEMA Standard LD3-1995.
2. Laminate bonded to 1” thick 47# M-3 particleboard core with PVA rigid adhesives. Contact method shall NOT be allowed. Core shall be balanced with HPL backer.
3. Joints shall be secured with adhesive and tight joint fasteners.
4. Provide 4” high back splashes where shown and at ends abutting walls and adjacent cabinets.
5. Countertops shall conform to ANSI A161.2-1979 PERFORMANCE STANDARDS FOR FABRICATED HIGH-PRESSURE DECORATIVE LAMINATE COUNTERTOPS.
6. No joints shall be closer than 24" either side of sink cutout..
7. No joints shall occur within kneespace.
8. Countertops containing sinks and countertops over dishwashers shall be exterior-grade veneer core plywood or moisture resistant medium density fiberboard, no substitutions.
9. Joint between backsplash and countertops containing sinks shall be sealed with sanitary, silicone sealant to ensure a tight seal.
10. Seal substrate at sink cutouts with sanitary, silicone sealant.

2.8 FABRICATION

A. Fabricate plastic laminate-faced casework to dimensions, profiles and details shown.

B. Assemble units in the shop in as large components as practicable to minimize field jointing.

C. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to a flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify site dimensions of cabinet locations in building prior to fabrication.

B. Verify location of wood blocking prior to installation of finish carpentry.

3.2 CASEWORK INSTALLATION

A. Installers: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics certified by manufacturer.

B. General: Install plumb, level, true and aligned with no distortions. Shim as required, using concealed shims. Where casework abuts other finished work or walls, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.

C. Base Cabinets:
1. Set cabinets straight, plumb and level. Adjust sub-tops within 1/16" of a single plane. Fasten each individual cabinet to blocking in wall with screws and finishing washers spaced 24" o.c. Bolt adjacent cabinets together into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16".
2. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24" o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.

D. Wall Cabinets
1. Securely fasten to solid blocking in partitions (not plaster, lath, or wallboard). Anchor, adjust and align wall cabinets as specified for base cabinets. Using screws with finishing washers, securely fasten each cabinet through back, near top, at not less than 24" o.c. Align similar adjoining doors to a tolerance of 1/16".

2. Adjust fronts and bottoms within 1/16" of a single plane.
3. Reinforcement of stud walls to support wall-mounted cabinets will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.

E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF TOPS

A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no jobsite processing of top and edge surfaces.

B. Fastenings: Use concealed clamping devices for field joints, located within 6" of front, at back edges and at intervals not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Secure tops to cabinets with "Z"-type fasteners or equivalent, using two or more fasteners at each front, end and back.

C. Workmanship:
1. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Provide flush hairline joints in top units using clamping devices.
2. After installation, carefully dress joints smooth, remove surface scratches, clean and polish entire surface.
3. Provide holes and cutouts as required for mechanical and electrical service fixtures.
4. Provide scribe moldings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use permanently elastic sealing compound recommended by manufacturer.

3.4 INSTALLATION OF ACCESSORIES

A. Install in a precise manner in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

B. Demonstration Mirror: Position mirror supports with mounting plates where shown on drawings. Fasten pre-drilled mounting plates to structure with bolts. Level supports to ensure mirror rotation.

C. Install grommets at knee spaces where electrical/telephone/data outlets are installed below countertop, whether detailed on drawings or not.

3.5 CLEANING AND PROTECTION

A. Clean Up: Remove cartons, debris, sawdust, scraps, etc., and leave spaces clean and casework ready for Owner's use.

B. Repair or remove and replace defective work as directed upon completion of installation.

C. Clean shop-finished surfaces, touch-up as required and remove or refinish damaged or soiled areas, as acceptable to Architect.

D. Protection: Advise contractor of procedures and precautions for protection of materials and installed plastic laminate-faced casework from damage by work of other trades.

END OF SECTION

SECTION 12 48 13

ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Entrance mats.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
   1. Provide manufacturer's installation instructions, including manufacturer’s approved adhesive with mat.
   2. Provide certification of manufacturer’s approval of adhesive.
   3. Provide warranty information.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Product/manufacturer; one of the following:
   NM 1754 Nomad Matting, Vinyl-backed; American Floor Products (phone 800.342.0424)
   Duromat, Vinyl-backed; Construction Specialties, Inc. (phone 800.233.8493)
   3M Nomad Cushion Plus Matting, Vinyl-backed; Mats, Inc. (phone 800.628.7462)

2.2 MATERIALS

A. Floor mat construction shall be loop-filament, anti-static vinyl material with built in chemical agents to reduce fungus and mildew.

B. Color(s) shall be selected by Architect from full range of colors.

C. Size of floor mat shall be the length of the vestibule, in the direction of travel, by the width of the vestibule, less 8".

D. Adhesive: Provide manufacturer’s recommended adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mats shall be cut to fit indicated areas.

B. Where used as floor finish, upper edge shall be level with adjacent finished floor surface.

C. On vinyl composition tile or porcelain tile, cut mat shall have nosing on all edges.

END OF SECTION

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SECTION 12 66 13

TELESCOPING BLEACHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Telescoping bleachers in the Gymnasiums.

B. Related Sections:
1. Division 26 Electrical: Wiring and connections for electrically operated telescoping bleachers.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Shop Drawings:
1. Indicate telescoping bleachers assembly layout.
2. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, anchorage to supporting structure, material types and finishes.
3. Include load capacities.
4. Wiring Diagrams: Indicate electrical wiring, power, signal, control, and connections.
5. Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.

C. Samples: Provide samples of material and color finishes.

D. Operating/Maintenance Manuals: Provide to Owner and demonstrate operating procedures.

E. Warranty: Submit manufacturer's standard product warranty for one year from date of Substantial Completion.

1.3 QUALITY ASSURANCE

A. Design Criteria:
1. Seating shall support and resist, in addition to its own weight, the following forces:
a. 100 lbs. per sq. ft. of live load.
b. 120 lbs. per linear foot of live load on seats and footrests.
c. Parallel sway load of 24 lbs. per linear foot of row.
d. Perpendicular sway load of 10 lbs. per linear foot of row.
2. Handrails shall be designed and constructed for:
a. A concentrated load of 200 lbs. applied at any point and in any direction.
b. A uniform load of 50 lbs. per ft. applied in any direction.
c. The concentrated and uniform loading conditions shall not be required to be applied simultaneously.
3. Guards shall be designed and constructed for:
a. A concentrated load of 200 lbs. applied at any point and in any direction along the top railing member and; a uniform load of 50 lbs. per ft. applied horizontally at the required guardrail height and simultaneous uniform load of 100 lbs. per ft. applied vertically downward at the top of the guardrail.
b. The concentrated and uniform loading conditions shall not be required to be applied simultaneously.

B. Manufacturer: Company specializing in telescopic seating with a minimum of 20 years' experience in manufacturing telescopic seating.

C. Engineer Qualifications: Manufacturer to employ a registered, licensed Professional Engineer in the state of Texas, to certify that the equipment to be supplied meets or exceeds the design criteria of this specification.

D. Welding Processes: To be performed by certified professional welding operators in accordance with American Welding Society, (AWS), D1,1 "Structural Welding Code-Steel."

1.4 WARRANTY

A. The manufacturer shall warrant all work performed under these specifications to be free of defects for a period of one year.

B. All understructure components shall be warranted for a period of ten years.

C. Any materials found to be defective within this period will be replaced at no cost to the owner.

1.5 MAINTENANCE

A. Extra Materials: Provide a 1% Attic Stock, or at least one unit of each style/type and size of seat.

B. Provide operation and maintenance instructions to the owner upon completion.

PART 2 - PRODUCTS

2.1 TELESCOPING BLEACHERS

A. Wall Attached Telescoping Bleachers manufactured by Hussey Seating – Specialty Supply & Installation LLC (936) 890-8997 Willis, Texas; Dick Norman
   1. Acceptable Manufactures
      a. Interkal (832) 626-1067 Academic Specialties Houston, Texas; Ryan Reynolds
      b. Irwin (972) 862-9900 ext 1020 Lone Star Furnishings, LLC Carrollton, Texas ; Brad Jones
   2. Description:
      a. Rise – 9 5/8"; Row Spacing - 24"; Number of rows – per drawings; Length of Sections - varies; Number of Sections – per drawings; Aisle Type - Slip resistant foot level aisles with intermediate risers; Aisle Width - 4'-0"; Seat Type - SculptureSeat with color as selected by Architect from manufacturer's full range.
      b. Bleachers to be Navy in color with “SMS” in white to one side and “Raiders” in white to the opposite side. Reference Section 09 99 00 -COLOR SCHEDULE
   3. Accessories:
      a. Steel, self-storing and 42" high "safety end rail" with 4" on center vertical balusters for exposed bank ends.
      b. End Panels: Full height, contoured stack closure panel at each exposed bank ends. Panels shall be constructed of ⅝" southern pine plywood attached to a steel framework. Panels shall be finished to match the deck board surface of high density polyethylene plastic in light grey or dark brown coating (color as selected by Architect), trimmed with aluminum edging.
      c. Provide full width automatic aluminum aisle closures.
      d. Provide standard 4'-0" wide foot level aisles at all aisle locations with intermediate tread and riser.
      e. Provide center handrail at each aisle to conform applicable code requirements.
      f. Accessible Seating Provisions: Provide first tier accessible cutouts per requirements of (ADA) Americans with Disabilities Act and Texas Accessibility Standards. Include manufacturer's standard front guardrail and closure panel below guardrail. Reference drawings for locations.
   4. Portable Power Assist –
      a. 115 V 20 amp service.
      b. ½ HP UL listed gear drive motor.
      c. Standard roller chain driven, (4) 6” diameter, 4” driver rollers on a 7/” tool steel axle shaft with ½” thick non-marking rubber with ¾” axle bearings.
      d. 800 lbs torque with front and rear mounted drive rollers

2.2 CONSTRUCTION

A. Wheels, soft face non-marring rubber 3½" diameter x 1⅛" face. 4 wheels shall be located directly under each moving column through row 10, 5 wheels per vertical column through rows 11-15 and 6 wheels per vertical column above row 15.

B. Steel columns shall be formed "boxed" channels of steel fitted with appropriate steel braces to meet design conditions.

C. Continuous "floating" interlock alignment shall be provided at the top and base of every moving column.

D. Modules shall each be 18" long unitized inter-locking engineered high density polyethylene modules, 10" wide, with not less than ¼" wall thickness. Color as selected by Architect from manufacturer's custom colors.

E. Enclose each end of seat row with matching end caps, designed with concealed attachment.

F. Decking shall be (Exterior Glued) 19/32" AC Grade 5-ply plywood with solid crossband. Surface sanded and free of voids. Color as selected by Architect.

G. Formed high tensile steel "Z" supports shall be provided for full perimeter, intermediate transverse stiffening and connection of decking.

H. Decking and "Z" supports shall form a rigid "closed deck" structure providing positive containment for personal articles such as clothing etc. Deck structure shall be designed to afford the maximum of personal privacy and safety, leaving no opening that a major human extremity could either accidentally or deliberately pass through.

2.3 FINISH

A. Steel: Finish understructure on all surfaces with (FS TT-E-508) grey enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish. Tubular steel which cannot be painted inside is unacceptable.

B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
   1. Steel nosing and rear risers shall be pregalvanized with a minimum spangle of G-60 zinc plating. Painted nosings or risers are unacceptable.
   2. Decking/paneling shall have surfaces to receive a moisture repellent sealer coat with "use" surfaces to receive two (2) coats high solids clear polyurethane stipple finish. Painted deck is unacceptable.

C. Aluminum: Corners and edges to be rounded and smoothed and receive an 0.7 mil thick anodic, clear, hard coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that area to receive telescoping bleachers is free of impediments interfering with installation and that condition of installation substrates are acceptable to receive telescoping bleachers in accordance with manufacturer's recommendations. Do not commence installation until conditions are satisfactory.

3.2 INSTALLATION

A. Install telescoping bleachers in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation and for permanent attachment to adjoining construction. Installation shall be by skilled mechanics under the direction of an experienced installation superintendent.

3.3 ADJUSTMENT AND CLEANING

A. Adjustment: After installation completion, lubricate, test and adjust each telescoping bleachers assembly to operate in compliance with manufacturer's operations manual.

B. Cleaning: Clean installed telescoping bleachers on both exposed and semi-exposed surfaces, leaving them free of soil and defects. Touch-up finishes to restore damaged or soiled surfaces. Remove cartons, crates and rubbish from the premises, and leave the area broom clean.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer to ensure telescoping bleachers are without damage or deterioration at time of substantial completion.

END OF SECTION

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SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide and install wheel stops.

B. Related Sections:
1. Section 32 13 13 - Concrete Paving.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include catalog, cuts of each type of sign and manufacturer's installation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle signs in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS and in manufacturer's cartons. Store off ground on planking. Cover with non-staining plastic.

1.4 PROJECT CONDITIONS

A. Coordinate installation of site furnishings with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wheel Stops: Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 10 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wheel Stops: Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops. Firmly bond each dowel to wheel stop and to pavement. Extend upper portion of dowel 5 inches into wheel stop and lower portion a minimum of 5 inches into pavement.

3.2 CLEANING

A. Clean exposed sign faces and galvanized surfaces, and leave free of defects. Use no abrasives. Leave pavement and graded area clean and free of debris.

END OF SECTION

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SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Conditions of the Contract including the General Conditions, Supplementary Conditions, and Division One, apply to all work of this Division, whether attached or not.

B. The requirements specified in this Section shall be applicable to work specified in other Sections within this Division.

1.2 SCOPE OF WORK

A. All Division 21 sections of these specifications shall include all labor and material to complete the entire fire suppression systems as specified and shown on the Drawings. All work shall be fully compliant with NFPA 13, 14, 24 Owner’s Insurance Carrier and Local Authority having jurisdiction.

B. All work shown and specified shall be completely installed and connected by mechanics properly qualified to perform the work required. All work shall be left in a satisfactory operating condition as determined by the Owner and Owner's Representative.

C. Provide all services and perform all operations required in connection with, or properly incidental to, the construction of complete and fully operating systems with all accessories as herein specified and shown on the Drawings.

D. Refer to "Conditions of Work" in Division 1

1.3 QUALITY ASSURANCE

A. The manufacturer shall be a firm regularly engaged in the manufacture of fire protection equipment and accessories of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. The installer shall be a firm with at least two (2) years of successful installation experience on projects with fire protection equipment and piping similar to that required for this project.

1.4 GENERAL

A. The accompanying Drawings show diagrammatically the general routing and location of the various equipment items and the major interconnecting piping and equipment and backflow preventers, as required by local authority having jurisdiction, without showing exact details as to elevations, offsets, control lines, and other installation details. The Contractor shall carefully lay out his work to conform to the site conditions, to avoid obstructions, provide proper grading of lines and fully comply with NFPA 13, 14, 24, Owner’s insurance carrier and local authority having jurisdiction. Exact locations of outlets, apparatus, and connections thereto shall be determined by reference to the Drawings, reviewed Shop Drawings, including equipment drawings, and rough-in drawings, by measurements at the building, and in cooperation with work specified in other sections of these specifications. Minor relocations necessitated by the conditions at the site or directed by the Architect shall be made without any additional cost to the Owner.

B. These specifications and the accompanying Drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will insure

complete and satisfactorily operating installations. Contractor shall coordinate the proper fitting of all material and apparatus into the building and shall prepare larger scale installation drawings for all critical areas, areas with limited working clearances, and areas of significant congestion requiring a higher level of coordination illustrating the installation of work specified in Division 21 in relation to all other portions of work specified in other Sections of these Specifications. Interferences with other portions of work, or the building structure, shall be corrected before any work proceeds. Should changes become necessary on account of the failure of the Contractor to comply with these stipulations, Contractor shall make all necessary changes at no expense to the Owner.

C. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted on the Drawings.

D. It is the intent of the Contract Documents to provide an installation complete and operational in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section, or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems and required to complete the installation.

E. Contractor sets forth that all personnel have the necessary technical training and ability; and that all work specified in this Division will be installed to the best standard of each trade, and will be complete and in good working order. If any of the requirements of the Drawings and specifications are impossible to perform, or if the installation when made in accordance with such requirements will not perform satisfactorily, report same to the Architect promptly after discovery of the discrepancy.

F. No extra compensation will be allowed for extra work or changes caused by failure to comply with the above requirements.

1.5 EXAMINATION OF THE SITE

A. Contractor shall visit the site, verify all items indicated on the Drawings or specified, and familiarize himself with the work conditions, hazards, grades, actual formations, soil conditions, points of connection, utility locations, and local requirements.

B. Contractor shall take these conditions into consideration, and the lack of specific information on the Drawings shall not relieve the Contractor of any responsibility.

C. All site visits shall be coordinated and scheduled with the Owner.

1.6 CUTTING AND PATCHING

A. Excessive cutting of the building structure, walls, floors, ceilings, roof, etc., will not be permitted. No structural member shall be notched or cut unless specifically shown on the Drawings, or unless such cutting is authorized by the Architect.

B. Provide for all holes or openings of proper size and shape as may be necessary for the proper installation of work specified in Division 21, consulting with the Architect regarding proper locations and sizes.

C. Where deemed necessary, and after consulting with the Architect, perform all cutting and patching required for the installation of piping, ductwork, etc. This shall include the cutting of concrete floors, concrete and tile floors, walls, ceilings, roofs, etc. It shall also include patching them as required to restore work to match existing finishes, following installation, testing, backfilling, insulation, etc.

D. Holes through concrete shall be drilled with "Mole", "Core-It', or other diamond point hole saw.

E. Refer to Division 01, Cutting and Patching.

1.7 CODE REQUIREMENTS

A. Contractor is required to comply with the requirements of all National, State, local codes and utility companies having jurisdiction and Owner's Insurance Carrier. In no case does this relieve the Contractor of the responsibility of complying with the requirements of these specifications and Drawings where specified conditions are of higher quality than the requirements of the above specified offices. Where requirements of the specifications and Drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above offices and shall notify the Architect promptly.

B. Contractor shall comply with the requirements and standards set forth by, but not limited to, the following:

1. (NFPA) National Fire Protection Association.
2. (OSHA) Occupational Safety and Health Administration.
3. (NEC) National Electric Code.
4. Local Plumbing Code.
5. Local Building Code.
6. Local Mechanical Code.
7. Local Fire Code.

C. Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction. Fees and costs incidental to these permits, inspections, and approvals must be assumed and paid by the Contractor.

1.8 RECORD DRAWINGS

A. Contractor shall, during the execution of work, maintain a complete set of "Record Drawings" upon which all locations of equipment, ductwork, piping, and all deviations and changes in the work shall be neatly recorded for use in producing "As Builts" at Project Close- Out. This shall include the incorporation of all Supplemental Drawings issued during the Construction Period.

B. All "Record Drawings" shall be reviewed monthly during the Construction Period, along with the monthly Pay Application Request.

C. Refer to Division 01, Execution and Close-Out Requirements.

1.9 RECORDS AND INSTRUCTIONS FOR OWNER

A. Accumulate during the job's progress the following sets, in triplicate, in accordance with the provisions of Division 01, Execution and Close-Out Requirements:

1. Warranties and guarantees and manufacturer's directions on equipment and material covered by the Contractor.
2. Equipment and fixture brochures, wiring diagrams, and control diagrams.
3. Copies of reviewed Shop Drawings, and material and equipment submittals. Copies of rejected submittals and Shop Drawings are not to be provided.
4. Operating instructions for fire protection systems. Operating instructions shall include recommended maintenance and testing procedures.
5. Other data and drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. Valve tag charts and diagrams specified elsewhere herein.
8. "As-Built" Record Drawings shall be provided in electronic format on a CD (provide two (2) copies) in a PDF or DWG format as determined by the Owner.
9. Provide copies of all City Inspection Certificates of Approval.
10. Provide Contractor's Certification Statement that all equipment furnished and all work performed is in compliance with all applicable codes referenced in these specifications, or those which are currently in effect.

B. Provide not less than one (1) day of operating instructions per building, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of all equipment.

C. All of the above data should be submitted to the Architect for approval at such time as the Contractor asks for his last payment request, just prior to his final payment request. In no case will any portion of retainage be released until these documents are submitted and accepted.

D. Refer to related portions of Division 1 for Project Close-Out requirements, Operation and Maintenance Data, Warranties, and other related certificates.

1.10 SHOP DRAWINGS AND SUBMITTALS

A. Contractor shall submit to the Architect shop drawings, product submittals, and catalog data on all equipment, devices and materials designated on the Drawings and specified herein. Electronic PDF copies of each shall be submitted.

B. Each submittal will be reviewed for compliance with general requirements of design and arrangement only; it is not a contract document and acknowledgment of compliance does not relieve the Contractor from responsibilities for performance of the work in compliance with all provisions and requirements of the Contract Documents. Job measurements and the coordination of all dimensions for proper fit of all parts of the work and performance of all equipment supplied to meet specification requirements are, and remain, specific responsibilities of the Contractor.

C. Shop Drawings shall be furnished by the Contractor for the work involved after receiving approval on the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job, and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary detailed drawings. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary; and, should there be any charges in connection with this, they shall be borne by the Contractor.

D. Shop Drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission on individual items shall designate the exact item offered and accessories as specified.

E. Shop Drawings are not intended to cover detailed quantitative lists of heating specialties, valves, air distribution devices, fixtures, and similar items, as the Drawings and specifications illustrate those items; and it is the Contractor's responsibility to procure the proper quantities required to comply with the established requirements.

F. Shop Drawings prepared to illustrate how equipment, piping, equipment, etc., can be fitted into available spaces will be examined under the assumption that the Contractor has verified the conditions shown. Review by the Architect shall not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those Shop Drawings.

G. Various material submissions of such items as shown valve assemblies, backflow preventers, and other related items or accessories shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets. Cover sheets for each item submitted shall have sufficient bare space to allow for shop drawing review stamps

H. Contractor shall process his submitted data to insure that it conforms to the requirements of the Drawings and specifications, and there are no omissions and/or duplications.

I. Shop Drawings and Submittals shall be accompanied by certification from the Contractor, and firm preparing such, that Shop Drawings have been checked for, and are in compliance with, the Contract Documents, NFPA, Owner's Insurance Carrier and local authority having jurisdiction.

J. All Submittals and Shop Drawings shall have been submitted for review by the Architect and Engineer within 90 days after Contract Award Date.

1.11 PENETRATIONS THROUGH FIRE-RATED ASSEMBLIES

A. Seal voids around pipes penetrating fire-rated assemblies and partitions using fire-stopping materials and methods in accordance with provisions in Section 07 84 00, Fire-Stopping.

1.12 DRAWINGS

A. Drawings show diagrammatically the locations of the various pipes, valves and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building, and in full cooperation with work specified in other Divisions of these specifications; and, in all cases, shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in the location of any of this work without additional cost to the Owner.

B. Should any changes be deemed necessary in items shown on the Contract Drawings, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Architect for approval.

C. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention prior to bids being submitted; otherwise, the Contractor shall be responsible for the cost of any and all changes and additions that may be necessary to accommodate the installation of any particular apparatus.

D. Lay out all work maintaining all lines, grades, and dimensions according to these Drawings with due consideration for the work of others. Verify all dimensions at the site prior to any fabrication or installation. Should any conflict develop or installation be found impractical, the Architect shall be notified before any installation or fabrication, and the existing conditions shall be investigated and proper changes effected without any additional cost.

E. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of materials and work. The Architect does not assume any responsibility, either direct or implied, for omissions or duplications by the Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.

1.13 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. Equipment supplied as portions of work specified under other Divisions of these specifications shall be furnished with proper roughing-in diagrams and shall be installed as a part of Division 21.

B. Furnish materials and labor required for the connection of this equipment.

C. Contractor shall ascertain that all equipment so specified is included as part of this work.

1.14 COOPERATION

A. Coordinate all work indicated in Division 21 with work specified in other Divisions to assure proper and adequate interface with other portions of the work.

B. Maintain contact and be familiar with the progress of the general construction and the timely installation of sleeves and inserts, etc., before concrete is placed. Install the required systems in their several stages, at the proper time to expedite the work and avoid unnecessary delays in the progress of other portions of the work.

C. Should any questions arise between work specified in Division 21 with respect to other portions of work specified in other Divisions of the Specifications, reference shall be made to the Architect for instructions.

1.15 MATERIALS AND EQUIPMENT

A. All materials and equipment purchased shall be new. No used or reconditioned equipment will be allowed unless specifically noted on the Drawings.

B. All material shall be manufactured in the United States and/or shall comply with the North America Free Trade Agreement, NAFTA

C. Substitutions: Products of same functions, performance and design will only be considered if in full accordance with the requirements of Division 01, Product Requirements. The products of other manufacturers will be acceptable; only if, in the opinion of the Architect, the substitute material is of a quality as good or better than the material specified, and will serve with equal efficiency, maintainability, and dependability, the purpose for which the items specified were intended.

D. Listed Manufacturers:

1. Manufacturers listed in a product or system specification are those manufacturers considered capable of manufacturing products conforming to the specification requirements, and are listed therein to establish a standard.
2. The "listing" of a manufacturer does not imply "acceptance" or "approval" of any standard product of that manufacturer.
3. Products offered by listed manufacturers shall be equal to, or superior in all respects to, that specified by named products; and shall meet or exceed specification requirements.
4. The description of specific qualities takes precedence over the reference standards and the description of qualities and reference standards together take precedence over the named product of listed manufacturers.

E. Product Options:

1. Products specified only by Reference Standards or by Description only means that any product meeting those standards or descriptions, by any manufacturer, will be considered.
2. Products specified by naming several products or manufacturers means that only the manufacturers named will be considered.
3. Products specified by naming only one product and manufacturer means that no option exists unless a substitution is accepted. Submit a request for substitution for any product or manufacturer not specifically named.
4. Products specified by Description, Reference Standard, and naming several products or manufacturers means that any product and manufacturer named meeting those descriptions and standards will be considered. Submit a request for substitution for any product or manufacturer not specifically named.

F. Limitations or Substitutions:

1. During Bidding Period, Instructions to Bidders, in Division 1, will govern times for submitting requests for substitutions under requirements specified in this Section.
2. No later than ten (10) days prior to the bid date, Contractor shall notify the Architect in writing of any desired substitutions of products in place of those specified. These requests will be considered; and, if a favorable response is determined, this will be documented in the form of an Addenda.
3. Substitutions will not be considered when indicated or implied on Shop Drawings or product data submittals without separate formal request, when requested directly by subcontractor or supplier, or when acceptance will require substantial revision of Contract Documents.
4. Substitute products shall not be ordered or installed without written acceptance.

5. Only one request for substitution for each product will be considered. If substitution is not accepted, Contractor shall provide specified product.
6. Architect will determine acceptability of any and all substitutions.

G. It is fully the Contractor's responsibility to assemble and submit sufficient technical information to fully illustrate that the material or equipment proposed for substitution is equal or superior, as the Architect is under no obligation to perform the service for the Contractor. The proposal shall be accompanied by manufacturer's engineering data, specification sheet, and a sample, if practical or if requested or specified. In no event shall a proposal for substitution be cause for delay of work. This shall include a detailed comparison to each product specification paragraph.

H. Should a substitution be accepted under the above provisions, and should the substitution prove defective or otherwise unsatisfactory for the intended service, within the warranty period, the Contractor shall replace the substitution with the equipment or material specified, and on which the specifications required him to base his proposal.

I. No substitutions will be considered contingent upon pending certification and rating agency approvals. Such certifications and ratings shall be in effect at the time of bidding.

1.16 EQUIPMENT SIZES AND REQUIREMENTS

A. Space allocations in machinery and mechanical equipment spaces are based on equipment scheduled in each case. Should the Contractor request a substitution for equipment of another make that requires more space in any critical dimension, the Contractor shall submit, together with other submittal data on the equipment, prints of drawings indicating how the equipment may be installed, indicating room for servicing and revisions in piping or ducting and any other details necessary for the Architect to form a judgment as to the suitability of the substitute material, as to performance, suitability for the space and other variables.

B. Duties of certain equipment items, horsepower’s of driving motors and electrical characteristics are scheduled for equipment items of a particular make in each case. Should requests for a substitute material be accepted which has other requirements that would involve allied equipment or other portions of work, the Contractor shall be responsible for all modifications required at no change in contract price. As examples:

1. If an accepted fire pump has a brake horsepower requirement above the motor horsepower scheduled, the Contractor shall be responsible for providing a larger motor and heavier drive and any change in size of the protective device, conduit run and conductors serving that motor. The latter shall be extended through an individual branch protective device and branch circuit on through the panel, feeder, feeder protective device, etc.
2. If accepted, fire pump, etc., having greater pressure drops than those on which pumping heads were based, the Contractor shall be responsible for selecting proper pumps and drives and adjusting electrical service work accordingly.

C. Structural steel members are indicated to provide supports for certain specific sizes and weights of equipment. Should a substitution request involve other equipment, the spacing of the supports shall be varied to suite the equipment. Should the weight or size of a proposed substituted item of equipment require additional supporting steel members, the Contractor shall include documentation of the additional supports in the request for substitution and install them at no change in contract price if the substitution is accepted.

D. Various large apparatus to be installed may require that the apparatus be installed prior to the installation of portions of structural, walls, or door frames. Coordinate the installation of these items to insure that no demolition of general construction is necessary for equipment installation or that the apparatus does not have to be disassembled for installation.

1.17 STORAGE AND PROTECTION OF MATERIALS

A. Store and protect materials and equipment as specified in Division 01, Product Requirements.

B. Contractor shall provide storage space for protection and storage of his materials and assume complete responsibility for all losses due to any cause whatsoever. All storage shall be within the property lines of the building site, and as directed by the Architect. In no case, shall storage interfere with traffic conditions in any public or project thoroughfare.

C. All work and material shall be protected at all times. Contractor shall make good any damage caused, either directly or indirectly, by his workmen. He shall be responsible for safe handling of all mechanical equipment and shall replace, without charge, all items damaged prior to acceptance by the Owner.

D. On site storage shall not be inside the building during construction progress, but shall be in approved trailers or as specifically approved otherwise by the Architect. Storage inside the building shall only be allowed when so allowed by the Architect.

1.18 FOUNDATIONS

A. Provide equipment foundations associated with the work specified in Division 21.

B. All top corners and edges of all foundations shall be neatly chamfered at a one inch (1") high 45 degree angle.

C. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling, and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary.

D. After removal of the forms, the surface of the foundation shall be rubbed until smooth.

E. Unless otherwise noted, foundations shall be four inches (4") thick for fire pumps and motors and other mechanical equipment, unless thicker foundations are required or recommended by the equipment manufacturer.

F. All concrete work shall conform to the requirements of Division 03, Cast-in-Place Concrete.

G. Provide housekeeping pads and foundations for every item of floor mounted equipment specified in Division 21 specifications. Pads shall extend a minimum of two inches (2") in each direction beyond the equipment size.

1.19 EXCAVATION AND BACKFILLING

A. Contractor shall do all necessary excavating and backfilling for the installation of his work. Trenches for underground conduits shall be excavated to required depths with bell holes provided as necessary to insure uniform bearing. Care shall be taken not to excavate below depth, and any excavation below depth shall be refilled with sand or gravel firmly compacted. Where rock or hard objects are encountered, they shall be excavated to a grade six inches (6") below the lowermost part of the piping and refilled to grade as specified. After the piping has been installed and reviewed by Architect and local building authorities, trenches shall be backfilled to grade with approved materials, well tamped or puddled compactly in place. Where streets, sidewalks, etc., are disturbed, cut, or damaged by this work, the expense of repairing same in a manner approved by Architect shall be a part of this contract.

B. Contractor shall bear sole responsibility for design and execution of acceptable trenching and shoring procedures, in accordance with State of Texas Regulations. On trench excavations in excess of five feet (5') in depth, Contractor shall pay a qualified engineer to prepare detailed Drawings and specifications directing Contractor in the safe execution of trenching and shoring. It is understood that trench safety

systems constitute a means and method of construction for which the Architect, Engineer, and Owner are not responsible. Accordingly, such documents when prepared, shall be separately issued by Contractor's Consultant, independent of project contract Documents.

1.20 WIRING

A. Unless otherwise noted, all wiring for motors, starters, and equipment is specified in Division 26.

B. Wiring of temperature controls shall be performed in accordance with the requirements of Division 26 but shall be performed as outlined in other sections of these specifications.

C. All power for control circuits required for the Fire Sprinkler System shall be provided and installed where indicated on the Division 26 Drawings, but shall otherwise be provided as indicated in other sections of these specifications.

D. Each supplier of equipment requiring control shall have wiring diagrams furnished with submittals. This shall be used to determine conduit layouts required to complete the electrical portions of the instrumentation and control systems.

E. All motors furnished as a portion of work specified in Division 21 shall be wired as specified in Division 26.

F. Except where combination starter-disconnects are specified elsewhere herein or in Division 26, all motors shall be provided with safety disconnect switches in accordance with the National Electrical Code as specified in Division 26.

G. Furnish all necessary wiring diagrams for equipment specified in Division 21, as a part of equipment submittals, for installation under other sections of these specifications.

1.21 EQUIPMENT STANDARDS

A. All basic materials and equipment shall be standard catalog products of a reputable manufacturer and shall essentially duplicate equipment which has been in satisfactory service for at least one (1) year.

B. First of a kind new technology devices will not be considered.

C. Accessory equipment that is required to make a complete and functioning system that is not of the same manufacturer furnishing the basic materials or equipment shall carry the guarantee of the basic material or equipment manufacturer and repair and replacement parts shall be available through normal trade channels locally.

1.22 CLEAN UP

A. Contractor shall be responsible for cleaning up after and during all work performed under this Division of the Specifications.

B. Contractor shall, on a daily basis, remove construction trash and debris accumulation to minimize the entrance of dust, dirt, and debris in piping, ductwork, and mechanical equipment.

C. At the completion of construction, just prior to Substantial Completion and sustained operation of equipment, thoroughly clean the inside of piping, valve assemblies, and devices.

D. Refer to Division 1.

1.23 FINAL CONSTRUCTION REVIEW

A. Schedule: Upon completion of the work specified in Division 21, there shall be a final construction review of the completed systems installations. Prior to this walk-thru, all work specified in this Division shall have

been completed and tested, in its final operating condition and the preliminary test report shall have been submitted to and approved by the Architect.

B. Personnel: A qualified person representing the Contractor must be present at this final construction review to demonstrate the system and prove the performance of the equipment.

C. Exceptions to the aforementioned requirements will be considered on a case-by-case basis dependent on the size and type of project, as well as construction schedule limitations.

1.24 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications.

B. Provide copies of all applicable approved notices and inspection certifications from the various inspections conducted by the Local Code Enforcement Authorities.

1.25 GUARANTEE

A. The guarantee provision of this specification requires prompt replacement of all defective workmanship and materials occurring within one year of final job acceptance, Substantial Completion, or as defined by Extended Warranty Contracts. This includes all work required to remove and replace the defective item and to make all necessary adjustments to restore the entire installation to its original specified operating condition and finish at the time of acceptance.

B. The Contractor shall also guarantee that the performance of all equipment furnished and installed under this Division of the Specifications shall be at least equal to the performance as called for in the specifications and as stated in the equipment submittals. Should there be indication that the equipment and installation is not operating as intended, the Contractor shall make further tests as the Owner's Representative may direct to demonstrate that the equipment installed meets the specifications and is delivering the capacity specified or called for on the Drawings.

C. If there is any indication that the equipment does not meet the specified quantities, the Contractor shall, at his expense, institute a program to demonstrate the adequacy of the installation. This program shall include all necessary testing and testing equipment. Should the Contractor not have the equipment or technical skill to perform the tests, it shall be his responsibility to employ recognized experts to perform the tests and shall provide certified laboratory tests, certified factory reports and work sheets, or other certified data to support results of any tests required.

END OF SECTION

SECTION 21 13 00

COMBINED WET FIRE SPRINKLER AND STANDPIPE SYSTEM

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with Division 21 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

1.2 SYSTEM DESCRIPTION

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of fire protection systems which shall include the automatic wet pipe sprinkler system and interior Fire Department valves in cabinets as shown on the Drawings, in locations as required by the Local AHJ and as approved by the Local authorities having jurisdiction for the new or renovated building.

B. The extent of Fire Sprinkler piping work is not indicated by drawings and schedules. The successful Sub-Contractor shall prepare and submit drawings and schedules for approval by the requirements of this section and is hereby defined to include (but is not necessarily limited to) purchase and complete installation of alarm check valves and trim, feed and cross main piping, branch line piping, test valves, test conditions and sprinklers, stainless steel backflow preventer assembly (type as required by Local AHJ) and inside Fire Department valve connections as required by local authorities. Fire Sprinklers, interior fire department valves and standpipes in stairwells shall be installed to serve the entire Building Complex.

C. A sprinkler/standpipe layout is not shown on the plans. The successful Sub-Contractor shall prepare shop drawings for the hydraulically designed sprinkler system and secure approval of same from the Owner’s Insurance Carrier, I.S.O. Commercial Risk Services Group representing the Texas State Insurance Authorities Review Board, and Local City Authorities. Approved plans and submittals shall be submitted to the Owner’s Representative for approval before any materials are fabricated.

D. The Sprinkler Systems shall be fed by the existing automatic wet alarm valve assemblies. Each system shall be limited to a maximum of 52,000 square feet per floor in accordance with NFPA-13 and 14, and International Fire Code. The Sub-Contractor shall rework the existing wet sprinkle system as required in order to accommodate areas of renovation, new construction and/or areas required by Local AHJ to be covered by the sprinkler system. This shall include but is not limited to the upsizing, reworking and extension of the fire main, sprinkler mains, cross mains and branch lines. The Sub-Contractor shall coordinate the removal and replacement of any existing ceiling affected by the sprinkler system rework with the General Contractor. Where existing systems are modified, the contractor shall match the existing sprinkler head types and provide escutcheons for all new and existing sprinkler heads as needed.

E. The Fire Department hose valves and standpipes shall meet the requirements of NFPA 14 as indicated and where required by the local Fire Department. The Fire Department valves shall be located in fire department hose valve cabinets and located in the stairwells. Cabinets shall be as specified herein and located per Architectural drawing. Provide fire department valve/standpipe classification as required by the local AHJ. The piping system shall be hydraulically calculated to include 500 gpm at 100 psig for a Class I standpipe system or 100 gpm at 65 psig for Class II standpipes at the most remote Fire Department valve location. Piping system shall be designed to withstand the maximum booster water pressure and flowrate from the local fire department pumpers.

F. The Contractor shall obtain from the City a current water flow test close as possible to the proposed building addition use this information for the basis of design of the hydraulically calculated system. Flow test shall have been taken in the last six months. Should a current flow test not be available, the Contractor shall conduct the test in the presence of the local fire department representative. This information shall be used for the basis of design of the hydraulically calculated system

G. The Contractor shall comply with NFPA 13, “Water Supply Treatment” in areas with water supplies known to have contributed to Microbiologically Influenced Corrosion (MIC) of sprinkler piping. The Contractor shall provide an Alternate Bid for testing and appropriately treating the water supply.

H. The Contractor shall obtain, from the City, a water flow test as close as possible to the proposed building site. The test shall have been taken within the last six months and this information shall be used for the basis of design of the hydraulically calculated system.

I. The sprinkler system shall designated to meet the hydraulically most remote requirements. Provide GPM density and remote area square footage as required by Owner’s Insurance Carrier and by NFPA Standards. (The most stringent shall be used).

J. In addition to the requirements of the governing authorities, the following design criteria shall be met:

1. A 10 psig safety factor shall be designed into all the hydraulic calculations.
2. The maximum velocity in the pipes shall not exceed 32 ft./sec.
3. Head spacing shall not exceed 400 sq. ft. for light hazard areas and 130 sq. ft. for ordinary hazard areas such as mechanical rooms. Head spacing shall be further restricted by ceiling type where appropriate per NFPA-13. Extended coverage heads may be used only where noted.
4. A main drain shall be provided next to the main sprinkler/standpipe riser.
5. Floor openings shall be projected by closely spaced sprinkler heads in combination with draft stops as required by NFPA 13.

1.3 QUALITY ASSURANCE

A. The manufacturer shall be a firm regularly engaged in the manufacture of fire protection equipment and accessories of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. The installer shall be a firm with at least two (2) years of successful installation experience on projects with fire protection equipment and piping similar to that required for this project.

C. The Contractor shall be licensed by the Texas Commission on Fire Protection for sprinkler installation and shall have five (5) years experience installing sprinkler systems of this size and scope. The contractor shall provide evidence of these requirements upon request. The contractor shall have an established service organization within a 50 mile radius of the job site.

D. FM Compliance: Comply with Factory Mutual “Approval Guide”.

1. FM approvals Marks: Provide units bearing FM approval marks.

E. UL Labels: Provide units which have been approved and listed by Underwriter’s Laboratories.

F. Comply with NFPA Standards, Governing Fire Prevention Code, Local Regulations and Ordinances governing fire sprinkler piping.

G. Coordinate with fire alarm installation for required monitoring of the sprinkler system.

H. All material shall be manufactured in the United States and/or shall comply with the North America Free Trade Agreement, NAFTA.

1.4 GOVERNING AUTHORITIES

A. Each combined standpipe and automatic sprinkler system shall comply with applicable State and City codes, with the requirements of other authorities having jurisdiction, and with the requirements of NFPA 13, 14 and 24.

B. Comply with all requirements of the Owner’s Insurance Carrier, and the City Authorities. Provide sprinkler products bearing approval from Underwriter’s Laboratories.

1.5 SUBMITTALS

A. Submit coordinated shop drawings and details of each fire protection system to, and receive approval from, the governing authorities before the submittal is forwarded to the Owner's Representative, and before installation work is started. Refer to Section 21 05 00 and appropriate Architectural section.

B. Submit to the Owner's Representative, upon completion of each system, a certificate stating that the work has been completed and tested in accordance with NFPA-13, that there are no defects in the system, and that it is operational. Test procedures and certificate format shall be in accordance with NFPA-13 and NFPA 14 unless otherwise directed by the governing authorities.

C. Submit to the Owner's Representative upon completion of the system, manufacturer data of all products incorporated in this work.

D. Submit the following Products Data, Shop Drawings and Samples:

	Product Data	Shop Drawings	Samples
Sprinklers	X	X	
Valves	X	X	
Hangers	X	X	
Jointing Method	X		
System Layout		X	

1.6 MAINTENANCE STOCK, FIRE SPRINKLERS

A. Maintenance Stock: For each style and temperature range required, furnish an additional two (2) fire sprinklers, cover plates and escutcheons, for every 100 units installed, but not less than six (6) units of each type and twelve (12) concealed sprinkler covers of each type.

1.7 COORDINATION

A. The Sub-Contractor shall examine all other work shown on the plans and such work installed at the job site. The sprinkler system Sub-Contractor shall coordinate the routing of his work with the other construction trades to avoid interference with the other installations. Pipe routing shall be located as required to avoid equipment, plumbing drain pipe, heating and air conditioning piping, ductwork, light fixtures, and electrical buss ducts. This Sub-Contractor shall provide pipe offsets, etc., as required to complete the installation. Shop prefabricated piping, pipe hangers, etc., shall be modified as required to fit the job site conditions.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Cover and protect materials in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall be rejected.

B. Storage and protection of materials shall be in accordance with Section 21 00 00.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall comply with the requirements of NFPA-13 and 14, Owner's insurance carrier/ I.S.O. Commercial Risk Services Group, U.L., FM, and Section 21 05 00.

2.2 PIPE AND FITTINGS

A. Underground within 5'-0" of the Building:

1. Type: AWWA C151, Class 52 cement lined, ductile iron.
2. Wrapping: Buried pipe wrapped with 8 mil polyethylene encasement, AWWA C105.
3. Buried Fittings (size 4 inch through 12 inch): Ductile iron compact type with push-on joints, ANSI A21.53/AWWA C153, or standard fittings, AWWA C110. Use mechanical joints with retainer glands where required for complete system. Equal to Tyco or Victaulic.
4. Underground riser, welded 304 stainless steel one-piece riser assembly with flanged end and tie-rod bracket, UL and FM approved, AMES Model "1 BR Series".

B. Underground 5'-0" beyond the Building: Pressure Class 200, polyvinyl chloride (PVC) water pipe conforming to ASTM D-2241, AWWA C-900 D.R. 14 with cast iron pipe outside dimension requirements of size indicated. Fittings shall be cast iron conforming to ANSI A21-10.

Above Grade, Indoor Piping: Pipe Size 2-1/2 Inch and Smaller ASTM A-53/135, Schedule 40, black steel pipe, piping by Bull Moose, Allied, or Wheatland Tube. Provide fittings as follows:

1. Fittings: Pipe Size 2-1/2 Inch and Smaller: Class 150 malleable iron, threaded fittings, ANSI B16.3.
2. Acceptable manufacturers: Victaulic, Tyco, or Anvil.

C. Above Grade, Indoor Piping: Pipe Size 3 Inch and Larger ASTM A-53/135, Schedule 10, black steel pipe, piping by Bull Moose, Allied, or Wheatland Tube. Provide fittings as follows:

1. Fittings: Pipe Size 3 Inch and Larger: UL listed, FM approved mechanical grooved couplings with flush sealed gasket style equal to Victaulic "AWWA Flush Seal".
2. Acceptable manufacturers: Victaulic, Tyco, or Anvil.

D. No Mechanical Tees shall be installed.

E. Outdoors or Exposed to Moisture: Same as specified for "Above Grade, Indoor Piping", except pipe shall be hot dipped galvanized.

F. Fire Sprinkler Drain Piping:

1. Pipe size 2" and smaller: Black steel pipe and fittings: Pipe weight: Schedule 40; Fittings: Class 125 cast iron screwed; Fittings: Class 150 malleable iron, screwed.
2. Pipe size 2-1/2" and larger: Black steel pipe and fittings: Pipe weight: Schedule 40; Fittings: Wrought iron or Schedule 10, rolled-grooved couplings and fittings.

2.3 PIPE SLEEVES

A. Pipe sleeves through grade beams or ground floor slab shall receive "Link Seal" closures made of interlocking synthetic rubber links. Seals shall provide for absolute water tightness. Seal shall be constructed to insulate electrically pipe from wall. Install as recommended by manufacturer. Provide Century-Line sleeves with water stop and anchor collar for pipes penetrating grade beams designated to be anchored.

2.4 VALVES

A. General: Conform to the requirements of NFPA-13 and NFPA-14.

B. Check Valves: Provide Victaulic “FireLok” 717 Series, or Tyco CV-1F, check valves 2-1/2" and larger with automatic ball drips for fire department connections.

C. Alarm Valve Assemblies: Provide approved alarm valves, 175 LBS rated pressure complete with all variable pressure trim, valves, etc., as required, equal to Tyco CV-1FR.

D. Sectional Valves: Provide indicating butterfly control valve, BFV-N, 175 LB rated working pressure, of size and end types indicated: 2-1/2" and larger: Tyco or Victaulic “FireLok” 705 Series.

2.5 AUTOMATIC SPRINKLERS

A. Fire Sprinklers: Provide standard coverage quick-response Bulb-Type, (“O-Ring” water seal design not acceptable) automatic fire sprinklers with 200 Deg. F for Electrical, MDF/IDF room, 155 Deg. F for other spaces or as required by NFPA-13, operating temperature of the following style and finish (all sprinkler heads shall be centered in the ceiling tiles). Acceptable manufacturer’s: Tyco, Reliable or Viking.

NOTE: Sprinklers shall be limited to 400 sq. ft. coverage for light hazard and 130 sq. ft. for ordinary hazard area. Extended coverage sprinklers are not allowed.

1. Upright type in mechanical spaces without ceilings equal to Tyco TY-FRB. Sprinkler Finish: Cast brass (in non-exposed areas) and chrome plated (in occupied areas).
2. Provide fully concealed pendent type in all finished areas with ceiling or soffit with factory painted "off-white" threaded cover plate equal to Tyco Quick Response concealed sprinkler model RFII “Royal Flush II”.
3. Provide upright extended coverage quick response sprinklers Tyco Model EC-5 or EC-8 only where indicated on the plans.

B. Emergency Head Storage Cabinet: Provide a red, baked enamel, steel sprinkler cabinet to store the extra sprinklers and wrenches, as required by NFPA-13.

C. Provide cage guards for sprinkler head in the Gymnasium, where exposed in the Locker Room and where sprinklers are installed at or below 8'-0". Cage guards shall be UL listed and engineered products equal to SprinkGuard products.

2.6 ACCESSORIES

A. Tamper Switches: Provide tamper switches equal to Potter Type OSYSU or PCVS Series on all control valves for connection to the fire alarm system.

B. Water Flow Detectors: Provide a water flow detector equal to Potter Type VSR Series at the main fire protection piping entrance to the building or system, in addition to other locations shown, specified, or required, to detect any flow in the system from any cause. If flow is detected, sound a local alarm. See fire alarm section for connection to fire alarm system.

C. Pressure Gauges: Provide 3-1/3 inch diameter, Potter-Roemer No. 6240 pressure gauges with stainless steel case and with a range of 0-300 psig, include gauge cock.

D. Wall Mounted Weather-Proof Horn/Strobe: Provide wall mounted weatherproof, red finished, 120V exterior horn/strobe UL listed FM approval with back box equal to Potter SH-120 Series.

E. Ball Drips: Provide Tyco AD-2, automatic ball drips for piping between check valves and fire department connections. Extend drain line from each ball drip to point of disposal as shown on the Drawings, or as directed.

F. Hangers and Supports: Provide hangers and supports as required by NFPA-13.

G. Flexible Sprinkler Drops shall only be allowed if they are hydraulically designed in the system calculations. Flex connections shall not exceed 36” in length. Flexible drops shall be braided stainless steel as manufactured by Flex Head or Victaulic VicFlex.

H. Automatic Air Vents: Provide as required by NFPA 13, shall be UL listed, FM approved rated up to 175 psig. Provide with ball valve and union upstream of the y-strainer. Potter PAV or pre-approved equal.

I. Outside Fire Department Connections:

1. Free standing type device shall be Potter-Roemer No. 5760, 2-way, Fire Department Connection with individual drop clapper valves, plugs, chain, and escutcheon lettered “AUTO.SPKR”. Entire unit shall have polished chrome finish, size shall be 2-1/2" x 2-1/2" x 4" with Knox Cap. Provide “Storz” connection as required by local Fire Department equal by Guardian Fire Equipment or Croker.

2.7 PROTECTION OF ELECTRICAL EQUIPMENT

A. Where required, provide metal hoods or shields to protect electrical equipment and bus ducts from sprinkler discharge.

B. No sprinkler mains or branches shall pass through an Electrical Room, IDF Room or MDF Room.

C. Only the branch line serving that specific Electrical Room, IDF Room or MDF Room shall enter that specific room.

2.8 FIRE DEPARTMENT VALVE AND CABINET

A. Provide 20 gauge fully-recessed solid metal steel box and solid metal door, 20 gauge flush solid aluminum door with 18 gauge frame with continuous steel hinge (Brass pin). Steel corner seams welded and ground smooth. Door and frame finished shall be determined by the Architect. Coordinate with Architect for finish. Cabinet shall be equal to Potter-Roemer #1810-AL-F.

B. Valve in Cabinet: Potter-Roemer 4500 Series 1700 U.L. rough brass 175 psig fire line angle valve with malleable iron handles, 2-1/2" x 2-1/2" with 1-1/2" reducer, Potter-Roemer 4600 Series 120 rough brass pin lug with threads suitable for connection of local fire department hoses.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install combined standpipe and automatic sprinkler system where shown on the Drawings or as noted. Installation shall comply with the requirements of NFPA-13 and NFPA-14, Local Fire Code, these Specifications, and the governing authorities, and with the manufacturers' written instructions. Coordinate with other work, including plumbing piping, as necessary to interface components of fire sprinkler piping properly with other work.

B. Welding shall comply with the requirements of Section 21 05 00 and State Insurance Authorities, and NFPA 51B. No butt welds are allowed.

C. Provide pipe offsets as required. Modify shop pre-fabricated piping, pipe hangers, and other components as required to fit the job site conditions.

D. No Mechanical Tees shall be installed.

E. Installation of hoods and shields for protection of electrical equipment shall be in accordance with approved details, included as a part of the coordinated shop drawings.

F. Install sectional valves in inlet piping at the bottom of each riser and in loops as indicated or required.

G. Install air vents at the high points of the sprinkler piping.

H. Install a tamper switch on hose connection cabinet door, each sectional valve and on each other shut-off valve.

I. Install drain piping at all low points of the sprinkler piping.

J. Thrust blocks shall comply with NFPA 24 and shall be of size required for the soil bearing strength and against compacted soil.

K. Install water flow detectors at each take-off from a sprinkler riser or for each zone.

L. Install pressure reducing valves as required by NFPA 13.

M. Install heads in all locations, pendant or upright, as required to provide complete coverage. Sprinkler shall be strictly coordinated with diffusers, grills, lights, ceiling type, and other trades.

N. Install sprinklers in finished ceilings to be centered on ceiling pattern; center of 2 x 2, or 2 x 4, tiles; centered both ways for special pattern ceilings. Coordinate head locations with ceiling finishes and types. Provide additional sprinklers as necessary for symmetrical layout. Refer to Architectural Reflected Ceiling Plan for ceiling type and suggested head location. Where head locations are not shown, locate as required and submit to Architect for approval prior to installation.

3.2 IDENTIFICATION

A. Apply signs to identify purposes and functions of controls, and to identify drain, test, and alarm valves. Provide letter sizes and styles as selected by the Owner's Representative from NFPA's suggested styles.

3.3 CLEANING AND FLUSHING

A. Prior to connecting sprinkler piping for flushing, flush water feed mains, lead-in connections and control portions of sprinkler piping. After sprinkler piping installation has been completed, and before piping is placed in service, flush each sprinkler system under pressure to remove foreign substances as required by NFPA-13 and NFPA-14. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.4 TESTS

A. After flushing each system, hydrostatically test sprinkler piping in accordance with NFPA-13 and NFPA-14. Check system for leakage at joints. Measure hydrostatic pressure at low point of each system or zone being tested.

B. Repair or replace piping system as required to eliminate leakage in accordance with NFPA Standards, then retest as specified to demonstrate compliance.

3.5 CERTIFICATION

A. Before final approval of the fire protection systems are requested, provide the Owner's Representative a statement that all requirements of the State Board of Insurance, City Building Inspection, Owner’s Insurance and Fire Departments have been met in the installation of the fire protection systems.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Conditions of the Contract including the General Conditions, Supplementary Conditions, and Division One, apply to all work of this Division, whether attached or not.

B. The requirements specified in this Section shall be applicable to work specified in other Sections within this Division.

1.2 SCOPE OF WORK

A. All Division 22 sections of these specifications shall include all labor and material to complete the entire mechanical systems as specified and shown on the Drawings.

B. All work shown and specified shall be completely installed and connected by mechanics properly qualified to perform the work required. All work shall be left in a satisfactory operating condition as determined by the Owner and Owner's Representative.

C. Provide all services and perform all operations required in connection with, or properly incidental to, the construction of complete and fully operating systems with all accessories as herein specified and shown on the Drawings.

D. Refer to "Conditions of Work" in Division 1

1.3 GENERAL

A. The accompanying Drawings show diagrammatically the sizes and location of the various equipment items and the sizes of the major interconnecting piping and without showing exact details as to elevations, offsets, control lines, and other installation details. The Contractor shall carefully lay out his work to conform to the site conditions, to avoid obstructions and provide proper grading of lines. Exact locations of outlets, apparatus, and connections thereto shall be determined by reference to the Drawings, reviewed Shop Drawings, including equipment drawings, and rough-in drawings, by measurements at the building, and in cooperation with work specified in other sections of these specifications. Minor relocations necessitated by the conditions at the site or directed by the Architect shall be made without any additional cost to the Owner.

B. These specifications and the accompanying Drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will insure complete and satisfactorily operating installations. Contractor shall coordinate the proper fitting of all material and apparatus into the building and shall prepare larger scale installation drawings for all critical areas, areas with limited working clearances, and areas of significant congestion requiring a higher level of coordination illustrating the installation of work specified in Division 22 in relation to all other portions of work specified in other Sections of these Specifications. Interferences with other portions of work, or the building structure, shall be corrected before any work proceeds. Should changes become necessary on account of the failure of the Contractor to comply with these stipulations, Contractor shall make all necessary changes at no expense to the Owner.

C. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted on the Drawings.

D. It is the intent of the Contract Documents to provide an installation complete and operational in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section, or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems and required to complete the installation.

E. Contractor sets forth that all personnel have the necessary technical training and ability; and that all work specified in this Division will be installed to the best standard of each trade, and will be complete and in good working order. If any of the requirements of the Drawings and specifications are impossible to perform, or if the installation when made in accordance with such requirements will not perform satisfactorily, report same to the Architect promptly after discovery of the discrepancy.

F. No extra compensation will be allowed for extra work or changes caused by failure to comply with the above requirements.

1.4 EXAMINATION OF THE SITE

A. Contractor shall visit the site, verify all items indicated on the Drawings or specified, and familiarize himself with the work conditions, hazards, grades, actual formations, soil conditions, points of connection, utility locations, and local requirements.

B. Contractor shall take these conditions into consideration, and the lack of specific information on the Drawings shall not relieve the Contractor of any responsibility.

C. All site visits shall be coordinated and scheduled with the Owner.

1.5 CUTTING AND PATCHING

A. Excessive cutting of the building structure, walls, floors, ceilings, roof, etc., will not be permitted. No structural member shall be notched or cut unless specifically shown on the Drawings, or unless such cutting is authorized by the Architect.

B. Provide for all holes or openings of proper size and shape as may be necessary for the proper installation of work specified in Division 22, consulting with the Architect regarding proper locations and sizes.

C. Where deemed necessary, and after consulting with the Architect, perform all cutting and patching required for the installation of piping, etc. This shall include the cutting of concrete floors, concrete and tile floors, walls, ceilings, roofs, etc. It shall also include patching them as required to restore work to match existing finishes, following installation, testing, backfilling, insulation, etc.

D. Holes through concrete shall be drilled with "Mole", "Core-It', or other diamond point hole saw.

E. Refer to Division 01, Cutting and Patching.

1.6 CODE REQUIREMENTS

A. Contractor is required to comply with the requirements of all National, State, and local codes and utility companies having jurisdiction. In no case does this relieve the Contractor of the responsibility of complying with the requirements of these specifications and Drawings where specified conditions are of higher quality than the requirements of the above specified offices. Where requirements of the specifications and Drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above offices and shall notify the Architect promptly.

B. Contractor shall comply with the requirements and standards set forth by, but not limited to, the following:

1. (NFPA) National Fire Protection Association.
2. (OSHA) Occupational Safety and Health Administration.

3. (NEC) National Electric Code.
4. (IECC) International Energy Conservation Code.
5. Local Plumbing Code.
6. Local Building Code.
7. Local Fire Code.
8. Local Energy Code.

Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction. Fees and costs incidental to these permits, inspections, and approvals must be assumed and paid by the Contractor.

1.7 RECORD DRAWINGS

A. Contractor shall, during the execution of work, maintain a complete set of “Record Drawings” upon which all locations of equipment, ductwork, piping, and all deviations and changes in the work shall be neatly recorded for use in producing "As Builts" at Project Close- Out. This shall include the incorporation of all Supplemental Drawings issued during the Construction Period.

B. All “Record Drawings” shall be reviewed monthly during the Construction Period, along with the monthly Pay Application Request.

C. Refer to Division 01, Execution and Close-Out Requirements.

1.8 RECORDS AND INSTRUCTIONS FOR OWNER

A. Accumulate during the job's progress the following sets, in triplicate, in accordance with the provisions of Division 01, Execution and Close-Out Requirements:

1. Warranties and guarantees and manufacturer's directions on equipment and material covered by the Contractor.
2. Equipment and fixture brochures, wiring diagrams, and control diagrams.
3. Copies of reviewed Shop Drawings, and material and equipment submittals. Copies of rejected submittals and Shop Drawings are not to be provided.
4. Operating instructions for heating and other plumbing systems. Operating instructions shall include recommended maintenance and seasonal change-over procedures.
5. Other data and drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. Valve tag charts and diagrams specified elsewhere herein.
8. "As-Built" Record Drawings shall be provided in electronic format on a CD (provide two (2) copies) in a PDF or DWG format as determined by the Owner.
9. Provide copies of all City Inspection Certificates of Approval.
10. Provide Contractor's Certification Statement that all equipment furnished and all work performed is in compliance with all applicable codes referenced in these specifications, or those which are currently in effect.

B. Provide not less than one (1) day of operating instructions per building, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of all equipment.

C. All of the above data should be submitted to the Architect for approval at such time as the Contractor asks for his last payment request, just prior to his final payment request. In no case will any portion of retainage be released until these documents are submitted and accepted.

D. Refer to related portions of Division 1 for Project Close-Out requirements, Operation and Maintenance Data, Warranties, and other related certificates.

1.9 SHOP DRAWINGS AND SUBMITTALS

A. Contractor shall submit to the Architect shop drawings, product submittals, and catalog data on all piping, equipment, and materials designated on the Drawings and specified herein. Electronic Pdf copies of each shall be submitted.

B. Contractor shall submit full product data shop drawings and shall prepare and submit 1/4" = 1'-0" scale plumbing piping shop drawings. Contractor shall fully coordinate all piping shop drawings with sheet metal shop drawings and other trades. Failure to submit shop drawings in a timely manner, as required to keep pace with the construction and work of all other trades, will result in delays, and possible stoppage, of payment to the contractor. Additionally, no work may proceed until such shop drawings are submitted, reviewed, and found to be acceptable by the engineer.

C. Each submittal will be reviewed for compliance with general requirements of design and arrangement only; it is not a contract document and acknowledgment of compliance does not relieve the Contractor from responsibilities for performance of the work in compliance with all provisions and requirements of the Contract Documents. Job measurements and the coordination of all dimensions for proper fit of all parts of the work and performance of all equipment supplied to meet specification requirements are, and remain, specific responsibilities of the Contractor.

D. Shop Drawings shall be furnished by the Contractor for the work involved after receiving approval on the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job, and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary detailed drawings. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary; and, should there be any charges in connection with this, they shall be borne by the Contractor.

E. Shop Drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission on individual items shall designate the exact item offered and accessories as specified.

F. Shop Drawings are not intended to cover detailed quantitative lists of valves, devices, fixtures, and similar items, as the Drawings and specifications illustrate those items; and it is the Contractor's responsibility to procure the proper quantities required to comply with the established requirements.

G. Shop Drawings prepared to illustrate how equipment, piping, etc., can be fitted into available spaces will be examined under the assumption that the Contractor has verified the conditions shown. Review by the Architect shall not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those Shop Drawings.

H. Various material submissions of such items as plumbing fixtures, drains, and other related items or accessories shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets. Cover sheets for each item submitted shall have sufficient bare space to allow for shop drawing review stamps.

I. Contractor shall process his submitted data to insure that it conforms to the requirements of the Drawings and specifications, and there are no omissions and/or duplications.

J. Shop Drawings and Submittals shall be accompanied by certification from the Contractor, and firm preparing such, that Shop Drawings have been checked for, and are in compliance with, the Contract Documents.

K. All Submittals and Shop Drawings shall have been submitted for review by the Architect and Engineer within 90 days after Contract Award Date.

1.10 PENETRATIONS THROUGH FIRE-RATED ASSEMBLIES

A. Seal voids around pipes penetrating fire-rated assemblies and partitions using fire-stopping materials and methods in accordance with provisions in Section 07 84 00, Fire-Stopping.

1.11 DRAWINGS

A. Drawings show diagrammatically the locations of the various pipes, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building, and in full cooperation with work specified in other Divisions of these specifications; and, in all cases, shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in the location of any of this work without additional cost to the Owner.

B. Should any changes be deemed necessary in items shown on the Contract Drawings, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Architect for approval.

C. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention prior to bids being submitted; otherwise, the Contractor shall be responsible for the cost of any and all changes and additions that may be necessary to accommodate the installation of any particular apparatus.

D. Lay out all work maintaining all lines, grades, and dimensions according to these Drawings with due consideration for the work of others. Verify all dimensions at the site prior to any fabrication or installation. Should any conflict develop or installation be found impractical, the Architect shall be notified before any installation or fabrication, and the existing conditions shall be investigated and proper changes effected without any additional cost.

E. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of materials and work. The Architect does not assume any responsibility, either direct or implied, for omissions or duplications by the Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.

1.12 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. Equipment supplied as portions of work specified under other Divisions of these specifications shall be furnished with proper roughing-in diagrams and shall be installed as a part of Division 22.

B. Furnish materials and labor required for the connection of this equipment.

C. Contractor shall ascertain that all equipment so specified is included as part of this work.

1.13 COOPERATION

A. Coordinate all work indicated in Division 22 with work specified in other Divisions to assure proper and adequate interface with other portions of the work.

B. Maintain contact and be familiar with the progress of the general construction and the timely installation of sleeves and inserts, etc., before concrete is placed. Install the required systems in their several stages, at the proper time to expedite the work and avoid unnecessary delays in the progress of other portions of the work.

C. Should any questions arise between work specified in Division 22 with respect to other portions of work specified in other Divisions of the Specifications, reference shall be made to the Architect for instructions.

1.14 MATERIALS AND EQUIPMENT

A. All materials and equipment purchased shall be new. No used or reconditioned equipment will be allowed.

B. All material shall be manufactured in the United States and/or shall comply with the North America Free Trade Agreement, NAFTA

C. Substitutions: Products of same functions, performance and design will only be considered if in full accordance with the requirements of Section 01 60 00, Product Requirements. The products of other manufacturers will be acceptable; only if, in the opinion of the Architect, the substitute material is of a quality as good or better than the material specified, and will serve with equal efficiency, maintainability, and dependability, the purpose for which the items specified were intended.

D. Listed Manufacturers:

1. Manufacturers listed in a product or system specification are those manufacturers considered capable of manufacturing products conforming to the specification requirements, and are listed therein to establish a standard.
2. The "listing" of a manufacturer does not imply "acceptance" or "approval" of any standard product of that manufacturer.
3. Products offered by listed manufacturers shall be equal to, or superior in all respects to, that specified by named products; and shall meet or exceed specification requirements.
4. The description of specific qualities takes precedence over the reference standards and the description of qualities and reference standards together take precedence over the named product of listed manufacturers.

E. Product Options:

1. Products specified only by Reference Standards or by Description only means that any product meeting those standards or descriptions, by any manufacturer, will be considered.
2. Products specified by naming several products or manufacturers means that only the manufacturers named will be considered.
3. Products specified by naming only one product and manufacturer means that no option exists unless a substitution is accepted. Submit a request for substitution for any product or manufacturer not specifically named.
4. Products specified by Description, Reference Standard, and naming several products or manufacturers means that any product and manufacturer named meeting those descriptions and standards will be considered. Submit a request for substitution for any product or manufacturer not specifically named.

F. Limitations or Substitutions:

1. During Bidding Period, Instructions to Bidders, in Division 1, will govern times for submitting requests for substitutions under requirements specified in this Section.
2. No later than ten (10) days prior to the bid date, Contractor shall notify the Architect in writing of any desired substitutions of products in place of those specified. These requests will be considered; and, if a favorable response is determined, this will be documented in the form of an Addenda.
3. Substitutions will not be considered when indicated or implied on Shop Drawings or product data submittals without separate formal request, when requested directly by subcontractor or supplier, or when acceptance will require substantial revision of Contract Documents.
4. Substitute products shall not be ordered or installed without written acceptance.
5. Only one request for substitution for each product will be considered. If substitution is not accepted, Contractor shall provide specified product.
6. Architect will determine acceptability of any and all substitutions.

G. It is fully the Contractor's responsibility to assemble and submit sufficient technical information to fully illustrate that the material or equipment proposed for substitution is equal or superior, as the Architect is under no obligation to perform the service for the Contractor. The proposal shall be accompanied by manufacturer's engineering data, specification sheet, and a sample, if practical or if requested or specified. In no event shall a proposal for substitution be cause for delay of work. This shall include a detailed comparison to each product specification paragraph.

H. Should a substitution be accepted under the above provisions, and should the substitution prove defective or otherwise unsatisfactory for the intended service, within the warranty period, the Contractor shall replace the substitution with the equipment or material specified, and on which the specifications required him to base his proposal.

I. No substitutions will be considered contingent upon pending certification and rating agency approvals. Such certifications and ratings shall be in effect at the time of bidding.

1.15 EQUIPMENT SIZES AND REQUIREMENTS

A. Space allocations in machinery and mechanical equipment spaces are based on equipment scheduled in each case. Should the Contractor request a substitution for equipment of another make that requires more space in any critical dimension, the Contractor shall submit, together with other submittal data on the equipment, prints of drawings indicating how the equipment may be installed, indicating room for servicing and revisions in piping or ducting and any other details necessary for the Architect to form a judgement as to the suitability of the substitute material, as to performance, suitability for the space and other variables.

B. Duties of certain equipment items, horsepowers of driving motors and electrical characteristics are scheduled for equipment items of a particular make in each case. Should requests for a substitute material be accepted which has other requirements that would involve allied equipment or other portions of work, the Contractor shall be responsible for all modifications required at no change in contract price. As examples:

1. If an accepted pump motor has a brake horsepower requirement above the motor horsepower scheduled, the Contractor shall be responsible for providing a larger motor and heavier drive and any change in size of the protective device, conduit run and conductors serving that motor. The latter shall be extended through an individual branch protective device and branch circuit on through the panel, feeder, feeder protective device, etc.
2. If accepted, water heaters having a different power voltage, phase or breaker size than those on which the heater were based, the Contractor shall be responsible for adjusting electrical service work accordingly.

C. Structural steel members are indicated to provide supports for certain specific sizes and weights of equipment. Should a substitution request involve other equipment, the spacing of the supports shall be varied to suite the equipment. Should the weight or size of a proposed substituted item of equipment require additional supporting steel members, the Contractor shall include documentation of the additional supports in the request for substitution and install them at no change in contract price if the substitution is accepted.

D. Various large apparatus to be installed may require that the apparatus be installed prior to the installation of portions of structural, walls, or door frames. Coordinate the installation of these items to insure that no demolition of general construction is necessary for equipment installation or that the apparatus does not have to be disassembled for installation.

1.16 STORAGE AND PROTECTION OF MATERIALS

A. Store and protect materials and equipment as specified in Section 01 60 00, Product Requirements.

B. Contractor shall provide storage space for protection and storage of his materials and assume complete responsibility for all losses due to any cause whatsoever. All storage shall be within the property lines of the building site, and as directed by the Architect. In no case, shall storage interfere with traffic conditions in any public or project thoroughfare.

C. All work and material shall be protected at all times. Contractor shall make good any damage caused, either directly or indirectly, by his workmen. He shall be responsible for safe handling of all mechanical equipment and shall replace, without charge, all items damaged prior to acceptance by the Owner.

D. On site storage shall not be inside the building during construction progress, but shall be in approved trailers or as specifically approved otherwise by the Architect. Storage inside the building shall only be allowed when so allowed by the Architect.

1.17 FOUNDATIONS

A. Provide equipment foundations associated with the work specified in Division 22.

B. All top corners and edges of all foundations shall be neatly chamfered at a one inch (1") high 45 degree angle.

C. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling, and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary.

D. After removal of the forms, the surface of the foundation shall be rubbed until smooth.

E. Unless otherwise noted, foundations shall be four inches (4") thick for plumbing equipment, unless specifically noted otherwise on the Drawings.

F. All concrete work shall conform to the requirements of Division 03, Cast-in-Place Concrete.

G. Provide housekeeping pads and foundations for every item of floor mounted equipment specified in Division 22 specifications. Pads shall extend a minimum of two inches (2") in each direction beyond the equipment size.

1.18 EXCAVATION AND BACKFILLING

A. Contractor shall do all necessary excavating and backfilling for the installation of his work. Trenches for underground piping shall be excavated to required depths with bell holes provided as necessary to insure uniform bearing. Care shall be taken not to excavate below depth, and any excavation below depth shall be refilled with sand or gravel firmly compacted. Where rock or hard objects are encountered, they shall be excavated to a grade six inches (6") below the lowermost part of the piping and refilled to grade as specified. Installation shall comply with ASTM D2321. After the piping has been installed and reviewed by Architect and local building authorities, trenches shall be backfilled to grade with approved non-expansive materials, well tamped or puddled compactly in place. Where streets, sidewalks, etc., are disturbed, cut, or damaged by this work, the expense of repairing same in a manner approved by Architect shall be a part of this contract.

B. Contractor shall bear sole responsibility for design and execution of acceptable trenching and shoring procedures, in accordance with State of Texas Regulations. On trench excavations in excess of five feet (5') in depth, Contractor shall pay a qualified engineer to prepare detailed Drawings and specifications directing Contractor in the safe execution of trenching and shoring. It is understood that trench safety systems constitute a means and method of construction for which the Architect, Engineer, and Owner are not responsible. Accordingly, such documents when prepared, shall be separately issued by Contractor's Consultant, independent of project contract Documents.

1.19 WIRING

A. Unless otherwise noted, all wiring for motors, starters, and equipment is specified in Division 26.

B. Wiring of temperature controls shall be performed in accordance with the requirements of Division 26 but shall be performed as outlined in other sections of these specifications.

C. All power for control circuits required for the Temperature Control System shall be provided and installed where indicated on the Division 26 Drawings, but shall otherwise be provided as indicated in other sections of these specifications.

D. Each supplier of equipment requiring control shall have wiring diagrams furnished with submittals. This shall be used to determine conduit layouts required to complete the electrical portions of the instrumentation and control systems.

E. All motors furnished as a portion of work specified in Division 22 shall be wired as specified in Division 26.

F. Except where combination starter-disconnects are specified elsewhere herein or in Division 26, all motors shall be provided with safety disconnect switches in accordance with the National Electrical Code as specified in Division 26.

G. Furnish all necessary wiring diagrams for equipment specified in Division 22, as a part of equipment submittals, for installation under other sections of these specifications.

1.20 EQUIPMENT STANDARDS

A. All basic materials and equipment shall be standard catalog products of a reputable manufacturer and shall essentially duplicate equipment which has been in satisfactory service for at least one (1) year.

B. First of a kind new technology devices will not be considered.

C. Accessory equipment that is required to make a complete and functioning system that is not of the same manufacturer furnishing the basic materials or equipment shall carry the guarantee of the basic material or equipment manufacturer and repair and replacement parts shall be available through normal trade channels locally.

1.21 CLEAN UP

A. Contractor shall be responsible for cleaning up after and during all work performed under this Division of the Specifications.

B. Contractor shall, on a daily basis, remove construction trash and debris accumulation to minimize the entrance of dust, dirt, and debris in piping, ductwork, and mechanical equipment.

C. At the completion of construction, just prior to Substantial Completion and sustained operation of equipment, thoroughly clean the inside of piping, ductwork, and equipment.

D. Refer to Division 1.

1.22 FINAL CONSTRUCTION REVIEW

A. Schedule: Upon completion of the work specified in Division 22, there shall be a final construction review of the completed plumbing systems installations. Prior to this walk-thru, all work specified in this Division shall have been completed, tested, adjusted, and balanced in its final operating condition and the preliminary test report shall have been submitted to and approved by the Architect.

B. Personnel: A qualified person representing the Contractor must be present at this final construction review to demonstrate the system and prove the performance of the equipment.

C. Building plumbing systems shall have been in operation for a minimum of 15 days and Test and Balance work shall be substantially complete prior to this review.

D. Exceptions to the aforementioned requirements will be considered on a case-by-case basis dependent on the size and type of project, as well as construction schedule limitations.

1.23 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications.

B. Provide copies of all applicable approved notices and inspection certifications from the various inspections conducted by the Local Code Enforcement Authorities.

1.24 GUARANTEE

A. The guarantee provision of this specification requires prompt replacement of all defective workmanship and materials occurring within one year of final job acceptance, Substantial Completion, or as defined by Extended Warranty Contracts. This includes all work required to remove and replace the defective item and to make all necessary adjustments to restore the entire installation to its original specified operating condition and finish at the time of acceptance.

B. The Contractor shall also guarantee that the performance of all equipment furnished and installed under this Division of the Specifications shall be at least equal to the performance as called for in the specifications and as stated in the equipment submittals. Should there be indication that the equipment and installation is not producing the intended conditions, the Contractor shall make further tests as the Owner's Representative may direct to demonstrate that the equipment installed meets the specifications and is delivering the capacity specified or called for on the Drawings.

C. If there is any indication that the equipment does not meet the specified quantities, the Contractor shall, at his expense, institute a program to demonstrate the adequacy of the installation. This program shall include all necessary testing and testing equipment. Should the Contractor not have the equipment or technical skill to perform the tests, it shall be his responsibility to employ recognized experts to perform the tests and shall provide certified laboratory tests, certified factory reports and work sheets, or other certified data to support results of any tests required.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING EQUIPMENT AND PIPING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 22 Sections as applicable. Refer to other Divisions for coordination of work with other portions of the work.

1.2 SYSTEM DESCRIPTION

A. Provide a complete system of Piping Identification as specified herein for each of the systems as described herein.

B. Provide a complete system of valve identification by the use of tags as described herein.

C. Provide a complete system of equipment identification tags as described herein.

1.3 QUALITY ASSURANCE

A. The installation of all mechanical system identification devices shall be performed under this Section of the Specifications using materials which are the product of reputable manufacturers. The application of the materials shall be in strict accordance with the published standards of the manufacturer of the materials, using any special materials as required by these specifications and by those published standards.

B. Manufactured Piping Identification markers, equipment name plates and valve tags shall be a product of Seton Name Plate Corporation, EMED Company, Inc., or Craftmark Identification to meet all ANSI Standards pertaining thereto.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions in accordance with Section 22 05 00.

B. Shop Drawings:

1. Submit a list of all piping systems to be identified, color of background to be used, legend or wording to be displayed for each system, and the intended location of all markers to be displayed.
2. Submit a list of equipment to receive identification tags, cut sheets and proof copies of tags which indicate location of tag and wording to be engraved thereon.
3. Submit a list of valves with location, indicate type of service, type of tag, tag number and proposed valve tag chart as specified herein.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Storage and protection of materials shall be in accordance with Section 22 05 00.

PART 2 - PRODUCTS

2.1 PIPING IDENTIFICATION SYSTEM

A. Furnish piping identification markers for all insulated and uninsulated piping systems in sizes and colors in accordance with ANSI Standard A13.1. Markers shall be as manufactured by Seton Name Plate Corporation similar to their vinyl plastic "Setmark" pipe markers with flow arrows. For systems with overall outside diameters under 6" use the snap-around markers. For systems with overall diameters 6" and over use strap-around markers attached with nylon ties.

B. Markers shall be provided as a minimum for the following systems:

1. Domestic Cold Water (Green background)
2. Domestic Hot Water (Yellow background)
3. Drains (Green background), for all insulated drains not contained in one space or roof; i.e., an A/C condensate drain in a fan room shall not require identification, whereas, as drain extending to another space would.
4. Storm Sewer (Green background)
5. Sanitary Sewer (Green background)
6. Sprinkler Piping (Red background)
7. Natural Gas (Yellow background)
8. Non-Potable Water (Blue background)

2.2 EQUIPMENT IDENTIFICATION

A. This Contractor shall provide identification plates similar and equal to Seton Name Plates, Style 2060.

B. Name plates shall be a minimum of 1/16" thick and 1" X 3" in size with beveled edges. The surface shall be a black satin with a white core for lettering. Each plate shall be drilled with two mounting holes sized for 3/8" No. 3 round head nickel plated steel screws. Lettering shall be a minimum of 3/16" high. Lettering shall be cut through the black surface to the white core. Only name plates equal to those specified will be considered. No punched plastic tape or engraved aluminum plates are acceptable. Stick-on only plates are not acceptable.

C. Provide and install identification plates on the cover of all starters or disconnects or combination starter-disconnects, where not mounted directly on the equipment, delivered by the mechanical system installer to the electrical systems installer and on each piece of Mechanical Equipment to include but not necessarily limited to:

1. Pumps.
2. Water Heaters.

D. Name plates shall have complete words describing equipment type, use and service. As an example, air handlers shall be designated "AHU-S-X MEP Shop" to designate the equipment as an air handler, number of air handler and area served. Use multiple or larger name plates as required to fulfill this requirement.

2.3 VALVE TAGS

A. Wire onto the handle of each valve installed a 19 gauge brass disc not under one and one-half inches (1-1/2") in diameter stamped with 1/4" high black paint filled letters over 1/2" high black paint filled numbers. Use "PLBG" as letters for Plumbing Valves, "AC" or "HVAC" for Air Conditioning System Water Valves or "FP" for Fire Protection Valves, followed by an identifying number. Tags shall be equivalent to Seton Style 250-BL.

B. Secure valve tags to valves by use of brass "S" hooks or brass jack chains.

C. The number, location, and purpose corresponding to each valve shall be listed in sequence, properly typewritten on a schedule sheet to be turned over to the Owner.

D. Provide two (2) framed valve tag charts with typed schedule sheets contained therein. Charts shall have an aluminum frame with clear plastic or lexan window.

2.4 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping or utilities. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum in width, color coded for the utility involved with suitable warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Provide for underground natural gas piping systems.

B. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

PART 3 - EXECUTION

3.1 PIPE MARKER INSTALLATION

A. Provide flow arrows at each marker location.

B. Markers shall be spaced not more than 20 feet on center and at each change of direction but not more than 4 feet in each direction from each elbow and tee. Markers not required on piping runouts less than four feet (4') in length and 1-1/4" or smaller in size.

C. Identification markers shall be installed on all new piping; indoors, outdoors and in the crawl space except for drain and waste lines 3/4" and smaller.

D. Install markers on exposed piping systems only after jacketing systems and finish paint coats are complete. Refer to Sections 09 90 00 and 22 07 00.

3.2 IDENTIFICATION TAG INSTALLATION

A. Secure tags level and in a conspicuous location with adhesive on equipment starters or combination starter disconnects and on the equipment where starters are not immediately adjacent to the equipment served.

B. Additionally, secure all tags with screw fasteners after secured with adhesive.

3.3 VALVE TAGS

A. Secure Valve tags to each valve with Brass "S" hooks or jack chains on each valve stem corresponding to the valve tag chart list.

B. Secure Valve Tag Chart List to Central Mechanical Room wall near the main entry at 60" above finished floor or where otherwise directed by the Architect. Provide second chart to Owner for their disposition.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 22 Sections as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.2 SYSTEM DESCRIPTION

A. Provide the systems of insulation which are specified for the control of heat transfer, sound control, and prevention of condensation.

B. Provide protective devices to prevent compression abrasion or puncture of the piping insulation systems installed to include inserts, pipe shields, PVC jacketing and aluminum jacketing as specified herein.

C. Provide piping identification systems as specified in Section 22 05 53, Identification for Plumbing Piping and Equipment.

1.3 QUALITY ASSURANCE

A. The installation of all thermal insulation shall be performed by a single firm regularly engaged in the insulation business, using skilled insulation mechanics and using insulation materials which are the product of reputable manufacturers. The application of the materials by the insulator shall be in accordance with the published standards of the manufacturer of the materials, using any special materials as required by these specifications and by those published standards.

B. Materials shall be manufactured by Schuller, Pittsburg Plate Glass, Owens-Corning, Foster, Certainteed, Mansville, or Knauf.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions to allow review of Materials and Methods to ensure complete compliance with specifications in accordance with Section 22 05 00.

B. Shop Drawings: Submit materials to be used and method of application for each system in tabular form. General statements not specifically identifying means or methods to be used shall be cause for rejection. Include descriptive data and cut sheets on each type of insulation material, sealing method, adhesives used, insert types, shield sizes, and PVC or aluminum jacketing as specified.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Promptly replace all damaged, deteriorated or wet insulation materials.

C. Storage and protection of materials shall be in accordance with Section 22 05 00.

PART 2 - PRODUCTS

2.1 PIPING AND EQUIPMENT INSULATION MATERIALS

A. Domestic Cold and Hot Water Supply, Return, and Non-Potable Water Piping Insulation:

1. Insulation shall be approximately 4 lb. or heavier in density, molded sectional glass fiber pipe covering with factory applied, white FRG, fire resistant, vapor barrier jacket.
2. Insulate valves and fittings with pre-molded glass fiber fitting covers equal in thickness to the adjoining pipe covering. In lieu of pre-molded fitting covers, for welded pipe fittings only, insulate with field fabricated mitered segments of pipe covering equal in density and thickness to the adjoining pipe covering. Use loose low density glass fiber insulation compressed tightly and equal to thickness of adjoining straight pipe sections for screwed fittings; vapor sealed with one 1/8" thick wet coat of water based Foster 30-33, Childers CP-33 vapor barrier coating, or approved equivalent. Vapor barriers- coatings shall have a maximum permeance rating of 0.07 at 43 mils dry film thickness per ASTM E-96, or equivalent adhesive, and imbedded in a glass fabric tape which has an emulsion imbedded in it and a coating on it; apply a second 1/8" thick coat of Foster No. 30-33, Childers CP-33 vapor barrier coating, or equivalent adhesive and apply a PVC jacketing as specified elsewhere herein.
3. Finish entire installation with PVC sheet jacketing where exposed from the finished floor up to 12'-0" above the finished floor including all portions of horizontal piping that occurs at and extends above 12'-0". Jacketing shall be applied to all straight piping sections, as well as all elbows, tees, valves, and fittings. Use "smoke-safe" PVC fitting covers, similar to Speedline 1, Knauf “Proto” or John Manville “Zeston 2000". Suitably seal all jacketing seams with tape, or other approved means, along the entire length of seams.
4. Loose "Diaper" inserts at fittings shall not be allowed.
5. Insulation thickness shall be as follows:

PIPING SYSTEMS	INSULATION THICKNESS - INCHES P I P E S I Z E S				
	RUNOUTS 3/4" & SMALLER	LESS THAN 1"	1" TO 1-1/4"	1-1/2" TO 3"	4" & OVER
Domestic Cold Water	1.00	1.00	1.00	1.00	1.00
Domestic Hot Water, Hot Water Return Water	1.00	1.00	1.00	1.50	1.50
Non-Potable Water	1.00	1.00	1.00	1.00	1.00
Storm & Overflow Drain	-	-	.5	.5	.5

B. Waste, Drain and Miscellaneous Lines:

1. Insulate the body of each floor and roof drain, where the body of the drain is out of the ground, or above a ceiling, with One-Coat of Insulating Cement, or equivalent, to a 1" thickness and coat with two 1/8" thick coats of Foster No. 30-80, Childers CP-33 vapor barrier coating, or equivalent adhesive, reinforced with an intermediate glass fabric tape saturated with lagging adhesive.
2. Waste lines for E.W.C.'s, floor drains receiving condensate from air handling equipment condensate pans to the point where they join the vertical stack or sanitary main.
3. Primary Roof Drainage System: All horizontal and vertical primary storm drainage piping to the point of penetration to the underfloor. Insulate as described for domestic water lines, except the insulation shall be minimum 1/2" thick (use 1" thick where 1/2" thick is unavailable in the pipe sizes needed). Complete vapor seal shall be required.
4. Overflow Roof Drainage System: The first vertical piece of the overflow drain pipe (below the drain body) and the first horizontal section of overflow drain piping to the first three feet (3') of vertical pipe

beyond that section: Insulate as described for domestic water lines, except the insulation shall be minimum 1/2" thick (use 1" thick where 1/2" thick is unavailable in the pipe sizes needed). Complete vapor seal shall be required.

5. Refer to PART 3 – EXECUTION for add installation requirements for storm and overflow drain bodies.

C. Expansion Tanks and Domestic Hot Water Storage Tanks: Insulate with 2" thick, approximately 4 lb. density fiberglass, pipe or board insulation, rigid, or rigid-scored- for-curvature; carefully cut and/or mitered to fit contours and point up voids and dents with insulating cement. Protect ASME labels from physical damage and being covered with mastic and insulation. Completely expose ASME labels and bevel insulation around such labels and seal exposed cut insulation with mastic. For domestic water system labels provide an "Armaflex" Patch, removable, 1/2" thick. Finish with PVC sheet jacketing similar to piping systems.

D. Plenum Safe Jacketing:

1. Where non-plenum rated piping (such as PVC, FRPP, PE, PP, etc.) is installed in return air plenums cover all exposed portions of this piping with a plenum safe jacketing, or wrap, system that is a factory manufactured and tested non-combustible barrier, to flame and smoke spread, designed to encapsulate non-rated or combustible items located in return air plenums, in accordance with the most recent additions of the International Building and Plumbing Codes.
2. Plenum safe jacketing shall be covered with a light weight fiberglass reinforced foil scrim finished high temperature rated insulation with an approximate density of 6 pounds per cubic foot. Jacketing shall have a Flame Spread and Smoke Developed rating of 0 for the unfaced blanket and be under 25 and 50 respectively for these items as tested in accordance with U.L. 723 and ASTM E-84. Maximum Flame Spread in accordance with U.L.1887 shall be 0 feet. Maximum smoke/optical density and Average Smoke per U.L.1887 testing shall not exceed 01 and 0 respectively. U.L. 1887 test procedure is a modified tunnel test which provides test data for flame spread and smoke density using a single plastic pipe and a bundle of plastic pipes of various sizes subjected to a fire test.
3. Thermal resistance of the barrier system shall be 4.2 as tested in accordance with ASTM C518. The Barrier System shall be able to withstand an operating temperature up to 2,300 Deg.F. and have a melting point of no lower than 3,100 Deg.F.
4. Plenum safe jacketing shall be a minimum 1/2 inch thick and have at least one side covered with a foil skin which must face the outer, or exposed, side. All joints in each direction shall be overlapped a minimum of one inch (1"). Jacket shall be secured tightly around the piping with either stainless steel banding or stainless steel tie wire. Use stainless steel crimp clamps on banding fasteners. Tie wires shall be secured using twist tensioning. Seal all cut edges with aluminum foil tape to ensure there is no exposed fiber.
5. Plenum safe jacketing shall be as manufactured by:

    a. Great Lakes Textiles, Inc. or approved equals by;
    b. 3M Corporation.
    c. Thermal Ceramics.
    d. FryeWrap by Unifrax.

E. Water Filled Drain, Domestic Water and any other Water Filled Lines Exposed to the Outdoors:

1. Protect to -10 degrees F. By wrapping with heat trace wire with thermostata strapped to lines.
2. Then insulate with 1" thick, 4 lb. Or heavier density molded glass fiber jacket covering with FRJ jacket. Insulate fittings same as described earlier herein for chilled and heating water piping.
3. Finally cover with an 0.016" thick aluminum with locked seams and banded joints made watertight. Jacketing shall be equivalent to Childers Aluminum roll jacketing confirming to ASTM B-209, with smooth mil finish.
4. Cover valves, mechanical couplings, and fittings with prefabricated aluminum jacketed fitting covers with factory applied moisture barriers to thickness to match that on piping and band in place. Fitting covers shall be equivalent to Childers ELL-JACS, Tee-Jacs, Flange-JACS, and Valve-JACS. Seal ends to prevent moisture penetration and to make completely weatherproof.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply insulation and pipe covering after all of the piping system to be insulated has been pressure tested, found to be completely tight (without leaks), and accepted as such. All insulated T-handles, blow-down valves, extended handles and caps should be installed prior to commencing with insulation. Verify that control, isolation, and balancing valves and any other piping specialty where a valve stem or test port extends beyond the normal pipe insulation thickness to be installed is installed pointed upward vertically. Thoroughly clean and dry all surfaces prior to being covered.

B. For operational systems, perform work after operational hours and only during periods of scheduled equipment shutdown. During this period water flow to the piping segments to be insulated shall be stopped and the water and piping shall have equalized in temperature with the average ambient temperature of the space in which the piping is installed. If time does not permit this to occur then apply heat to the piping in a controlled, suitable manner, to warm the water and pipe sufficient to prevent any condensation from occurring during the insulation process. For any segments to be left uninsulated until the next system shutdown, mastic seal the ends and penetrations through of the installed insulation and allow sealant to dry prior to re-energizing the water system. Continue to insulate the piping system in small enough portions after-hours, or as required, to insure no insulation is applied over a wet surface.

C. In the covering of surfaces subject to low temperatures (below 60 Deg. F.), take extreme precautions to secure a complete vapor seal and avoid air pockets of any kind within the insulation. All insulation shall be tightly fitted to the piping system and all systems shall have an equal thickness and density of insulation around all piping, valves, strainers, accessories, etc. Where fiberglass insulation is cut to contour insulation around valves or strainers add additional insulation to obtain the overall insulation thickness specified. Where vapor barrier jackets are lapped at seams and joints, paste such flaps carefully to assure no break in the vapor seal. Seal around butt joints with strips of vapor barrier jacket. Use self-sealing laps on all insulation for pipes carrying a medium below 60 Deg.F. Stapling will not be permitted where vapor barrier jackets are specified. Vapor barriers for these systems shall have a perm rating not to exceed 0.05.

D. On glass fiber pipe covering with factory applied vapor barrier jacket, lap the jacket on the longitudinal seams and seal with vapor barrier lap adhesive equivalent to water based Foster 30-33, Childers CP-33 vapor barrier coating, or approved equivalent. Vapor barriers - coatings shall adhere to a maximum permeance rating of 0.07 at 43 mils dry film thickness per ASTM E-96. Tightly butt the ends and cover butt joints with a 4" wide band of vapor barrier jacket secured with the same adhesive. At all run-out piping to water equipment mastic seal the ends of the branch piping insulation where it meets the main piping insulation to prevent the migration of moisture should it ever become trapped in the insulation system. Generally, mastic seal the ends of butt joints in water piping systems every 50 feet for the entire system.

E. Where jacketing systems are specified, use standard weight, PVC sheet rolls. Exercise care to locate seams in an inconspicuous place and apply all jacketing neatly, including that on valves and fittings. Unsightly work will be considered a justifiable basis for rejection. Adhere the jacketing in all cases with a lagging adhesive, Foster 30-36 A F (Anti-Fungal) or Childers CP-137 AF, or other approved methods. Lagging adhesives shall meet ASTM D 5590 with a “0" growth rating.

F. All insulation shall be continuous through wall and ceiling openings and sleeves.

G. All insulation and accessories shall have composite (insulation, jacket and adhesive used to adhere the jacket to the insulation) fire and smoke hazard ratings as tested under procedure ASTM E-84, NFPA 255, and UL 723 not exceeding:

Flame Spread	25
Smoke Developed	50
Fuel Contributed	50

H. No insulation shall be applied to the bodies of unions and flanges on domestic hot water supply and circulating lines only. Terminate the insulation short of the unions or flanges at this equipment, and bevel off at a forty five degree angle to permit "breaking" the union or removal of the flange bolts without damaging the insulation. Bevel the insulation off also at caps on scale pockets, and blow-off connections on strainers, and at valve bonnets on these same systems.

I. Unsightly work shall be cause for rejection, including poor application of adhesives and coatings beyond the insulation which coats valves or other piping specialties.

J. Damage or Modification to Insulation: Where new insulation is disturbed or damaged during the process of installing other new materials, making new connections, etc., it shall be repaired or replaced to return it to its original condition and appearance. Where lines are removed and connections to insulated lines are capped, insulate those caps as well as repairing damaged insulation. Materials shall match those presently installed in thickness, density, insulating value, jacketing, etc.

K. Miscellaneous Lines: Piping connected to water lines through which there might be fluid flow on occasions such as the lines connected to air vents, lines running to compression tanks, etc. shall be insulated as described for other piping in those systems.

L. Hanger and Support Locations: At the location of hangers or supports for pipes run above ground and finished with a vapor seal insulation, provide rigid sections of cork, Foamglas, calcium silicate or high density polyurethane, at least the same thickness as the adjacent insulating material to adequately support the pipe without compression of the insulating material and cover with a vapor seal that is bonded to the adjacent insulation as described for fittings in the lines. Where the insert has an insulating value less than the adjacent pipe insulation the thickness of the insert shall be increased to equal the insulating value of the adjacent pipe insulation. Wood inserts shall not be allowed. Hangers and supports for piping insulation to receive a vapor barrier shall be installed exterior to the insulation.

M. Material Changes: Wherever there is a change in materials on lines that are vapor sealed, apply a suitable adhesive that is compatible with both materials, tapes, etc., as required to maintain the vapor barrier.

N. The following describes materials, thickness and finishes for insulation on piping. In the following "exposed" shall mean any pipe exposed below the finished ceiling and structure where no ceiling is installed, in any room space, area, mechanical rooms, closets, and any pump run exterior to the building, including above the roof. "Concealed" shall mean any pipe located above ceilings, in furrings, in chases, in crawl spaces, and buried in direct contact with the soil.

O. In all "exposed" areas, up to 12'-0" above the finished floor, insulation shall receive a PVC jacketing system. Neatly install all jacketing for finish painting.

P. Roof and Overflow Drain Bodies:

1. Provide 12”x1” jacketed fiberglass pipe insulation on the upper section of the roof drain body. Provide additional pipe insulation, 10”x1” into the 12”x1” insulation, 8”x1” into the 10”x1”, etc. until a telescopic reducing bushing is created to match the actual pipe size.
2. Fill voids around drain body and underdeck collar with Owen Corning, or equal fiberglass batt insulation, minimum R-22.
3. Measure and cut Manson Insulation “AK Board” to fit the outside diameter of the underdeck collar and interior diameter of the insulated drain line.
4. Slit AK Board and fit into place, sealing split with 3M Aluminum Foil Tape.
5. Seal & Paint entire jacketed drain body with Childers CP-11 white mastic.

Q. All insulation materials and jacketing shall exhibit the following characteristics:

1. Water sorption, per ASTM C 1104, shall be less than 0.02%.
2. Linear shrinkage, per ASTM C 356, shall be negligible.
3. Stress corrosion, per ASTM C 795, shall not cause corrosion.
4. Corrosiveness, per ASTM C 665, shall not be any greater than sterile cotton.
5. Resistance to fungi, mold and mildew and bacteria, per ASTM C 665, shall be rated as not promoting growth of fungi and bacteria. Inhibitors shall be added to specified products to meet these requirements.

3.2 SHIELDS AND INSERTS

A. Metal saddles, shields, shall be applied between hangers or supports and the pipe insulation. Saddles shall be formed to fit the insulation and shall extend up to the centerline of the pipe and the length specified for hanger inserts. Shields shall be made of galvanized sheet metal and shall be of sufficient size and length to prohibit the crushing of the insulation materials. Saddle shields shall be as follows:

Pipe Size	Metal Saddles	
	Metal Gauge	Length
3/4" to 3"	18	12"
4" to 6"	16	12" - 18"
8" to 10"	14	24"
12" & Larger	12	24"

B. Provide inserts of calcium silicate on hot piping and cellular glass or 7#/Cu.Ft. fiber glass pipe insulation on cold piping at hangers except pipes 1-1/2" or smaller in size. Inserts between the pipe and pipe hangers shall consist of rigid pipe insulation of a thickness equal to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall not be less than the following lengths:

Pipe Size	Insert Length
3/4" to 3"	12"
4" to 6"	12" - 18"
8" to 10"	24"
12" & Larger	24"

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING SYSTEM

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 01 - General Requirements and referenced documents.

B. Comply with Division 22 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

1.2 SYSTEM DESCRIPTION

A. Provide a complete system of domestic hot and cold water supply as indicated herein and as illustrated on the contract drawings.

B. Provide isolation of systems through valving as shown or indicated herein.

C. Provide a system free of water hammer.

D. Isolate all piping components to eliminate all audible vibration and noise.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

B. Indicate on submittal piping material and joining method for each system and for the various sizes of piping systems to be installed. This shall be in tabular form in one location.

C. Product Data:

1. Pipe.
2. Fittings.
3. Joining methods.
4. Shock arrestors.
5. Hose bibbs.
6. Hydrants.
7. Backflow preventers.
8. Trap Primer.

D. Certification: Submit certification that completed system complies with sterilization procedures and test requirements of municipality, State, and other public authorities having jurisdiction over system sterilization.

E. Submit copies of pressure test data of water systems to Owner prior to time of final completion of construction work.

F. Provide closeout documents as required in Division 1, Section 01 17 00.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in following order of precedence:

1. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing.
2. Provisions specified in this Section.
3. International Plumbing Code.

B. Installer shall have been doing related work as described herein for a minimum of 5 years.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Above ground:

1. 3 Inch and Smaller:

a. Pipe: Hard drawn copper water tube, ASTM B88, Type "L".
b. Fittings:

1) 3 Inch and smaller, wrought copper solder joint fittings, ANSI B16.22.

c. Joint solder:

1) 95% tin - 5% antimony for pipe sizes 2" and less.
2) Or 95.5% tin, 4% copper and 0.5% silver based for pipe sizes 2" and less.
3) "Silfos" for pipe sizes 2-1/2" and larger.
4) No lead containing solder is allowed.

d. Alternative Joint method:

1)Zero Lead Press Joints, copper & copper alloy press fitting shall conform to material requirements of ASME B16.18 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM and shall be factory installed with a leakage path feature that will assure leakage of liquids from inside the engineered system past the sealing element of an unpressed connection. Acceptable manufactures: Viega, Nibco or Mueller

B. Underground 5'-0" beyond exterior of building:

1. 3 Inch and Smaller:

a. Piping: Hard drawn or annealed copper tube, ASTM B88, Type K.
b. Fittings: Wrought copper solder joint fittings, ANSI B16.22
c. Joint solder: "Silfos" only, no lead containing solder allowed.

C. Underground piping within 5'-0" exterior of building:

1. 2 Inch and Below:

a. Pipe: Annealed copper coils, ASTM B88, Type K.
b. Fittings: No fittings allowed below slab.

2. 2-1/2 Inch to 3 Inch:

a. Pipe: Annealed copper tube, ASTM B88, Type K.
b. Fittings: No fittings allowed below slab.

D. Unions:

1. 3 Inch and Smaller: ANSI B16.22 wrought copper; solder end fittings.

E. Valves and Supports: Provide lead-free bronze full-port ball valves with stainless steel trim for pipe sizes 2" and smaller. Provide flanged lead-free bronze or epoxy coated full port valves with stainless steel trim from pipe sizes 2-1/2” or larger. Butterfly valve are not allowed. Refer to Section 22 05 00 and 22 21 13, Basic Materials and Methods.

2.2 SPECIALTIES

A. Access Doors:

1. Milcor "Style K, M, or DW", stainless steel to suit surface application.

2. Panels to have cam locks and door sized 18 inches by 18 inches
3. All restroom/toilets and kitchen areas shall have stainless steel access doors.

B. Shock Arrestors:

1. Acceptable manufacturer: Sioux Chief Manufacturing Co., Precision Plumbing Products (PPP), Josam, Jay R. Smith.
2. One piece, seamless copper construction.
3. Piston type, triple "O" ring copper construction.
4. Factory charged.
5. Plumbing Drainage Institute (PDI) certified.
6. ASSE 1010 approved with lifetime warranty, not requiring access.
7. Size as shown on drawings or as recommended by manufacturer.
8. Acceptable product: "Hydra-Rester", Sioux Chief Manufacturing Co.

C. Air Chambers: Same material and size as pipe branch or riser; minimum of 18" long.

D. Trap Primer:

1. Automatic Trap Primer shall be designed to deliver potable water to floor drains. The trap primer shall operate with a line pressure drop of 5 to 10 psi. Trap primer shall be diaphragm operated to work on line pressure drops and spikes to automatically maintain a constant water seal in P-traps. Where required by Local Authorities Having Jurisdiction, provide indirect connection between automatic trap primers and trap primer line that connects directly to drain body or p-trap.
2. TP-1: Precision Plumbing Products, Inc., Model "CPO-500" with proper distribution unit as shown on floor plan and/or riser diagrams.

E. Vacuum Breakers:

1. Acceptable manufacturer:
    a. Watts.
    b. Febco.
    c. Beeco.
2. Atmospheric, check valve type.
3. Bronze body construction with polished chrome finish.

F. Reduced Pressure Type Backflow Preventer Assembly:

1. Acceptable manufacturers:
    a. Watts.
    b. Beeco.
    c. Ames.
2. Double check valve type with shutoff valves.
    a. Quarter turn ball shut-off valves up to 2-1/2 Inches.
    b. Outside stem and yoke gate shut-off valves 3 Inches and over.
3. Differential pressure type relief valve with air gap fitting.
4. Lead-Free bronze body construction up to 2-1/2 Inches.
5. Cast iron body construction 3 Inches and over.
6. Provide in-line upstream y-type strainer.
    a. 20 mesh strainer 2 Inches and below.
    b. 0.125 perforated screen mesh 2-1/2 Inches and over.
7. Acceptable Product: Watts No. 909S (FDA)-QT.

G. Double Check Backflow Preventer Assembly:

1. Acceptable manufacturers:
    a. Watts.

b. Beeco.
c. Ames.

2. Double check valve type with shutoff valves.

a. Quarter turn ball shut-off valves up to 2-1/2 Inches.
b. Outside stem and yoke gate shut-off valves 3 Inches and over.

3. Lead-Free bronze body construction up to 2-1/2 Inches.
4. Cast iron body construction 3 Inches and over with stainless steel internal ports and FDA approved fused epoxy coating.
5. Provide in-line upstream y-type strainer.

a. 20 mesh strainer 2 Inches and below.
b. 0.125 perforated screen mesh 2-1/2 Inches and over.

6. Acceptable Product: Watts No. 709S (FDA)-QT.

H. Hose Bibbs Within Mechanical Rooms or Unfinished Building Space: 3/4" chrome plated brass compressed cocks; hose connection; key handle, lock shield, vacuum breaker; Chicago No. 998 or No. 952, as required; or equivalent by T&S Brass or Woodford.

I. Wall Hydrants - Exposed Non-Freeze Wall Hydrant with Integral Vacuum Breaker: Josam #71300-54-95 cast bronze hydrant with satin nickaloy scoriated with cylinder vandalproof lock face, integral backflow preventer. "T" handle key, and bronze casing with 3/4" universal inlet connection.

J. Interior Wall Hydrants - Finished Areas: 3/4" hose bibb with anti-siphon vacuum breaker in wall box with polished chrome locking cover, lose key handle equal to Woodford Model B-74.

K. Non-Freeze Roof Hydrant: 3/4" NPT male brass nozzle hose thread freezeless roof hydrant with 304 stainless steel shroud and base, 125 pound 7" globe angle valve, quick disconnect with built-in vacuum breaker, under deck flange, drain down reservoir utilizing the “Venturi Principle”, and black powder coated cast aluminum weather-guard dome handle. MAPA Model MPH-24FP.

2.3 DOMESTIC WATER CONDITIONING SYSTEM

A. The Contractor shall provide an electromagnetic pulse generator on each domestic water main and on each domestic hot water return line, just prior to reconnecting to the water heater. This pulse generator shall hold molecularly change the “scaling” properties of the calcium and magnesium carbonates located in the water supply. The main supply shall be provided with an EasyWater “No-Salt Conditioner” EF-50-IN and the domestic hot water return piping shall be provided with an EasyWater “No-Salt Conditioner” CS400.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations.

B. All piping shall be properly cleaned and reamed to the full inside diameter of the pipe size prior to joining.

C. Connections to Equipment:

1. Install necessary pipe connections and fittings required to connect equipment.
2. No rough-in shall be done before drawings of equipment are received.
3. Make all final connections to include unions or flanges to facilitate future removal.
4. Install cutoff valves on equipment connections.

D. Install shock arrestor ahead of each quick closing valve, at top of each riser and on pipe run to water closets as recommended by manufacturer. Shock arrestors shall be accessible as required by Local Codes.

E. Install backflow preventers at connections to closed mechanical water system makeup such as chilled water and hot water systems and beverage dispenser connections as required by Local Codes.

F. Pressure reducing valve assembly shall be installed as required when city water supply pressure exceeds 72.5 psig at the building domestic water header.

G. Strictly coordinate locations of wall clean out cover plates and access doors. Submit locations to the Architect prior to installation for final approval.

3.2 FIELD QUALITY CONTROL

A. Testing:

1. Furnish instruments, equipment, and labor necessary to conduct tests.
2. Methods of sampling, inspecting, and testing shall conform to local codes.
3. Tests of plumbing systems:
    a. Plumbing piping systems shall be pressure tested.
    b. Underground piping shall be tested and successfully repaired prior to backfilling.
4. Water Systems:
    a. When rough-in is completed and before fixtures are set, entire hot and cold water and piping systems shall be tested at hydrostatic pressure of not less than 100 psig, and approved tight at this pressure for not less than 30 minutes.
    b. Where portion of water piping system is to be concealed before completion, portion shall be tested separately as specified for entire system.
5. Domestic hot water circulating system: Balance and check prior to final inspection and provided with sufficient thermometers installed at time of final construction review to prove that water is circulating in all piping loops to fixtures.
6. Defective work:
    a. If inspection or test shows defects, defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated.
    b. Repairs to piping shall be made with new materials.
    c. No caulking of screwed joints or holes will be acceptable.

B. Disinfection:

1. After pressure tests have been made and leaks repaired, flush entire domestic water distribution system with water until entrained dirt and mud have been removed.
2. On the building side of each water meter assembly, provide a minimum 3/4 inch connection for injection of sterilizing fluid to disinfect the piping system chlorinating materials utilizing liquid chlorine or calcium hypochlorite shall be used.
3. Provide dosage of not less than 50 parts per million.
4. Retain treated water in pipe long enough to destroy all non-spore forming bacteria.
5. Retention time shall be at least 24 hrs. and shall produce not less than 10 ppm of chlorine at extreme end of system at end of retention period.
6. Open and close valves in system being disinfected several times during contact period.
7. Flush system with clean water until residual chlorine is reduced to less than 1.0 ppm versus 0.2 at the most remote fixture.
8. During flushing period, open and close valves and faucets several times at several locations.
9. From several points in system, take samples of water in properly disinfected containers for bacterial examination.
10. Repeat disinfecting until satisfactory bacteriological results have been obtained and City Health Dept. has made final approval of test.

3.3 ADJUSTING AND CLEANING

A. Equipment, pipes, and valves shall be cleaned of grease, metal cuttings, and sludge that may have accumulated from operation of system during test.

B. Stoppage, discoloration, or other damage to finish, furnishing, or parts of building, due to failure to properly clean piping system, shall be repaired.

C. When work is complete, adjust hot water systems for uniform circulation.

D. Adjust flush valves and automatic control devices for proper operation

END OF SECTION

SECTION 22 11 23

NATURAL GAS PIPING SYSTEM

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with Division 22 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

C. Comply with Local Governing Gas Codes, and the requirements of the Authorities Having Jurisdiction.

1.2 SYSTEM DESCRIPTION

A. Provide a complete natural gas piping system as indicated herein and as illustrated on the contract drawings.

B. Make connections to water heaters, HVAC equipment, kitchen equipment or other devices as specified here or as shown on the drawings.

C. Provide gas cocks, pressure regulators, dirt legs, valves and unions or other devices as indicated and as required by the local authorities having jurisdiction.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 1.

B. Indicate on submittal piping material and joining method for each system and for the various sizes of piping systems to be installed. This shall be in tabular form in one location.

C. Product Data:

1. Pipe.
2. Fittings.
3. Joining methods.
4. Valves.
5. Clean Gas pressure regulators.
6. Vents.

D. Certification: Submit certification that completed system complies with test requirements of municipality, State, and other public authorities having jurisdiction over system.

E. Provide closeout documents as required in Division 1.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in following order of precedence:

1. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing, including local codes.
2. Provisions specified in this Section.
3. Applicable provisions of standards of National Fire Protection Association (NFPA).
4. Applicable provisions of standards of American Gas Association (AGA).
5. International Plumbing Code and Fuel Gas Code.
6. Local Gas Utility Requirements.

B. Installer shall have been doing related work as described herein for a minimum of 5 years.

PART 2 - PRODUCTS

2.1 MASTER METER

A. Contractor shall coordinate revised gas service requirements with the Local Natural Gas Utility Company to insure the timely provision of this service to keep up with the project requirements. Coordinate exact pipe routing, size, installation, and system pressure requirements with utility company. Contractor shall coordinate with and pay all costs to the Utility Company for all new gas piping from the off-site gas main trunk connection up to the property line, extended onto the site up to and including the gas meter installation at the proposed location. Contractor shall install gas piping from the gas meter up to the building entry point. This system shall be provided with the service pressure noted with isolation valves, test ports, and regulation components to adjust the downstream pressure to that indicated.

B. Contractor shall furnish to the local gas utility company a detailed itemized list of all gas fired equipment including required operating supply pressure and MBTU input requirement of each piece of equipment.

2.2 ABOVE GROUND PIPE AND FITTINGS

A. Pipe: ASTM A53, Grade A or B, seamless, Schedule 40, standard weight black steel.

1. 2 Inches and Smaller: Threaded and coupled.
2. 2-1/2 Inches and Larger: Butt welded joints
3. All gas piping in sleeves shall have welded joints, regardless of size.

B. Fittings, 2 Inches and Smaller: ASTM A197, 150 LB black malleable iron, screwed joint. Piping system with pressure of 2 psig or greater shall have socket welded joints for all sizes.

C. Fittings, 2-1/2 Inches and Larger: ASTM A234, WPB standard weight, weld joint fittings.

D. Unions, 2 Inches and Smaller: ASTM A197, 150 LB, black malleable iron, screwed joint, brass to iron ground joint.

E. Flanges:

1. Use for 2-1/2 Inches and larger pipe.
2. ASTM A181, Grade 1, 150 LB, flat faced, weld neck.
3. Gaskets:

a. Acceptable manufacturers:

1) Manville.
2) Cranite.

b. 150 LB, 1/16 Inch full-faced, punched sheet, 650 Deg.F. rating suitable for gas service.
c. Bolting: ASTM A307, Grade B, heavy hex head machine bolt with heavy hex nuts.

2.3 UNDER GROUND PIPE AND FITTINGS BEYOND THE BUILDING EXTERIOR

A. Polyethylene Pipe: ASTM D2513, D2683, and D3261, Type PE 2306; SDR 9.3 through 21.

B. Fittings: Socket and butt type, thermally bonded.

C. Joints: Thermally bonded heat fusion joints.

D. Tracer Wire: Seton underground gas line warning tape, yellow color with "Caution - Gas Line Buried Below" continuously labeled, minimum 0.004 inch thick polyethylene, with metallic core, two inches wide.

E. Service Riser: Schedule 40 pre-bent galvanized steel riser with transition and protective coating and anode as detailed on the Drawings. Provide anodeless service riser where required by Local Authorities.

2.4 VALVES

A. Acceptable Manufacturers:

1. SMG Global
2. Milwaukee
3. Hammond
4. McDonald.

B. Valves: 125 LB iron cocks, flat head, non-lubricated plug with resilient double seal, screwed ends or flanged, for natural gas service.

C. Acceptable Product: "Series 400", Key Port valve by SMG Global with RS49 (HYCAR) plug seals, U.L. listed for natural gas shut-off.

2.5 GAS PRESSURE REGULATORS

A. Acceptable Manufacturers:

1. Rockwell/Equimeter.
2. Fisher.
3. Sensus.
4. Itron

B. Regulators:

1. Adjustable type, with automatic loading.
2. Provide with automatic pressure relief.
3. Provide means for removing and renewing valve.
4. Adjust for outlet pressure required.
5. Outlet pressure shall not vary more than 1/2 inch water column from setting point at connected load capacity for regulator.

C. Pressure Relief: Diaphragm operated, spring loaded type with vent for relief of excess pressure on low pressure side of each main service regulator.

D. All equipment shall be furnished with final regulator.

E. Regulators shall have bugproof screened vent cap installed in vent tapping.

F. When regulators are installed inside the building and venting of the regulator is required, extend the vent full size to the outside and terminate vent with a gooseneck with a bugproof screen.

G. Acceptable Product: Rockwell Model 143, 243 or 121 as determined by inlet and outlet pressure, pipe size and CFH capacity.

H. Provide secondary regulators at individual equipment connections where required to deliver manufacturer’s recommended delivery pressure to equipment.

2.6 ROOF GAS PIPE SUPPORTS

A. Pipe supports shall have galvanized or stainless steel adjustable height hard cast rubber roller w/ nylon bushing pipe supports for all roof top utility lines. Refer to manufacturer's recommendations for spacing and appropriate pipe support size of pipe. provide, as a minimum supports as follows:

1. Within 3’-0” of all equipment connections
2. Within 2’-0” of each change in direction, elbow & tee.
3. Not more than every 10’-0” on centers beyond those indicated above.

B. Provide Mapa model MS-5 or equal by Erico or Miro

C. Provide with Traffic Pad, Mapa model WP1016.

2.7 VENT CAPS

A. Caps shall be weatherproof with bugproof screened vent.

B. Caps shall be double outlet vent cap, slip-on type with set screw or threaded, with aluminum body and 40 mesh stainless wire cloth as manufactured by Morrison Bros. Co., OPW or Universal.

2.8 GAS PIPE SLEEVES

A. Exterior underground:

1. Schedule 40 PVC.
2. Solvent weld joints.
3. Terminate vent sleeve above ground with Schedule 40 galvanized steel, gooseneck with bug proof screen.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Cap or plug pipe openings during installation.

B. Cover and protect piping, fixtures and equipment against dirt, water, weather, and chemical or mechanical injury.

C. Run Piping Concealed and Sleeved in Finished Rooms unless Indicated Otherwise:

1. Terminate lower end of vertical supply piping near burners or equipment connections.
2. Terminate with tee, nipple, and cap to serve as dirt trap.
3. Where gas burning kitchen equipment is located adjacent to other gas burning kitchen equipment, provide manifold for battery.
4. Connect each end of a manifold to gas distribution system to maintain uniform gas pressure at each piece of equipment, two (2) point service.
5. All final equipment connections shall consist of a union and shut-off valve.

D. Threaded Joints:

1. Taper threads and cut evenly; make with graphite and oil.
2. After cutting and before threading, ream pipe to remove burrs.
3. Use appropriate pipe joint thread compound.
4. Caulking of threaded joints after joining to stop or prevent leaks will not be permitted.

E. Welded Joints:

1. Fusion-weld in accordance with ANSI B31.8, make changes in direction of piping with welding fittings only.
2. Mitering or notching pipe to form elbows and tees will not be permitted except for sleeves as indicated elsewhere herein.
3. Make branch connections with welding tees or forged welding branch outlets except for sleeves as indicated elsewhere herein.

F. Beveling:

1. Make field and shop bevels by mechanical means or flame cutting.
2. Where beveling is done by flame cutting, clean surfaces of scale and oxidation prior to welding.

G. Alignment:

1. Before welding, align component parts to be welded so no strain is placed on weld when finally positioned.
2. Set flanges and branches true.
3. Maintain alignment during welding operation.

H. Make final connection to equipment using rigid pipe and fittings.

I. Place fire stop where pipes pass through fire walls, fire partitions, or floors.

J. Sleeves:

1. Install continuous pipe sleeve around gas piping above ceilings, in vertical chases, and at all concealed piping within the building.
2. Seal all sleeves airtight inside the building except where noted, and allowed by Authorities Having Jurisdiction, to terminate in ventilated space.
3. Vent all sleeves to the outside. Terminate sleeve to prevent entrance of water and insects.
4. Size and install gas pipe sleeves to permit replacement of gas piping without damage to building structure.
5. Terminate gas sleeve vents a minimum of eight inches (8") above the roof with specified vent cap. All exposed vent piping on roof or above grade shall be Schedule 40 galvanized steel pipe.
6. Vent to have free area equal to the net free area between the sleeve and the largest gas pipe contained therein.
7. All gas piping in sleeves shall have welded joints regardless of pipe size.
8. Where the end sealing is capable of withstanding the full pressure of the gas pipe the vented sleeve shall be designed for the same pressure as the pipe.

K. Underground Pipe Coatings: Refer to Section 22 05 00 and Local Gas Codes.

L. Piping on roof:

1. Piping shall be supported on roof supports furnished and installed under Division 07 of the Architectural specifications and as recommended by the roofing manufacturer at a spacing not to exceed 10'-0" on center and within 3'-0" of each equipment connection or branch pipe.
2. Offset pipes to be 8" minimum above the roof at all expansion joints, roof penetrations, perimeter gravel stops/fascia and vertically flashed surfaces.
3. Unless noted otherwise, bottom of pipe shall be minimum of 4" above roof or roof ballast.
4. Do not secure piping to supports unless detailed otherwise.
5. Exposed piping shall be coated with red primer and a minimum of two coats of paint. Preparation of piping and painting shall comply with other applicable sections in Division I.
6. Pipe installer shall determine exact layout of piping and locate all required supports.

3.2 FIELD QUALITY CONTROL

A. Set up in accessible position, where directed, test pump and mercury gauge connected to permanent gas piping.

B. Protect pump and gauge and keep in working order until after final inspection.

C. Remove as directed.

D. Before appliances are connected, piping systems shall withstand a test pressure of 150 percent of the maximum working pressure or 30 PSIG, whichever is greater, for a period of not less than one (1) hour without showing a drop in pressure.

E. Pressure calibrated instruments shall read in increments of not greater than 0.1 LB when measured with mercury manometer or slope gauge.

F. Pressurize system, then isolate source of pressure before pressure tests are made.

G. Test gas piping with dry air only.

H. If test fails, repair all leaks and retest until the test passes.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT SYSTEM

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 01 - General Requirements and referenced documents.

B. Comply with Division 22 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

1.2 SYSTEM DESCRIPTION

A. Provide a complete sanitary waste and vent system as indicated herein and as illustrated on the contract drawings.

B. Make connections to grease traps, oil interceptors, sewage ejectors, sump pumps or other devices as specified here or as shown on the drawings.

C. Provide trap primer connections on floor drains or other devices as indicated and as required by the local authorities having jurisdiction.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 30 00.

B. Indicate on submittal piping material and joining method for each system and for the various sizes of piping systems to be installed. This shall be in tabular form in one location.

C. Product Data:

1. Pipe.
2. Fittings.
3. Joining methods.
4. Floor drains.
5. Clean outs.

D. Certification: Submit certification that completed system complies with test requirements of municipality, State, and other public authorities having jurisdiction over system.

E. Provide closeout documents as required in Division 1, Section 01 70 00.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in following order of precedence:

1. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing, including local codes.
2. Provisions specified in this Section.
3. International Plumbing Code.

B. Installer shall have been doing related work as described herein for a minimum of 5 years.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Above ground:

1. Schedule 40 PVC Piping Above Grade:

a. Pipe 1-1/2 - 6 inches: Poly Vinyl Chloride (PVC) schedule 40, drain waste vent (DWV) pipe, ASTM D2466, ASTM D 2321, ASTM D2665 and ASTM 1785, NSF stamped and approved. System shall be rated for 200 psi minimum pressure.
b. Fittings 1-1/2 - 6 inches: Poly Vinyl Chloride (PVC) schedule 40, DWV patterned fittings, ASTM D2466 and ASTM 1784, NSF stamped and approved.
c. Solvent Cement: Shall comply with pipe and fitting manufacturer's recommendations and shall be a two (2) step process with Primer manufactured for thermoplastic piping systems and solvent cement per manufacturer and shall conform to ASTM D2564 and ASTM F656.
d. Anywhere non-plenum rated pipe is installed in return air plenums, all exposed portions of this pipe shall be covered with a plenum safe jacketing, or wrap, system per Insulation Specification 22 07 00 or use cast iron piping as specified above.

B. Schedule 40 PVC Piping Below Grade:

1. Pipe 1-1/2 - 6 inches: Poly Vinyl Chloride (PVC) schedule 40, drain waste vent (DWV) pipe, ASTM D2466, ASTM D 2321, ASTM D2665 and ASTM 1785, NSF stamped and approved. System shall be rated for 200 psi minimum pressure.
2. Fittings 1-1/2 - 6 inches: Poly Vinyl Chloride (PVC) schedule 40, DWV patterned fittings, ASTM D2466 and ASTM 1784, NSF stamped and approved.
3. Solvent Cement: Shall comply with pipe and fitting manufacturer's recommendations and shall be a two (2) step process with Primer manufactured for thermoplastic piping systems and solvent cement per manufacturer and shall conform to ASTM D2564 and ASTM F656.
4. PVC pipe material shall not be allowed to serve fixtures, drains, or equipment subject to receiving fluids with temperatures of 140 Deg.F. or higher. Provide cast iron service weight pipe and fittings as specified above and extend a minimum of 20' (twenty feet) or to main waste line to assure high temperature cools in cast iron pipe before entering PVC piping material.

C. Optional Piping below grade as approved by Authorities having jurisdiction:

1. Piping beyond 5'-0" of Building Exterior:

a. Polyvinyl Chloride Pipe (PVC) shall be in compliance with ASTM D2321, ASTM D3034, SDR-35, or ASTM F-679 (UNI-BELL UNI-B-7), as applicable, Total allowable deflection of pipe shall be 5 percent of the base diameter. Deflection shall be defined as the reduction of vertical diameter.
b. Joints: Polyvinyl Chloride (PVC) solvent weld joints up to 8" pipe diameter and Factory pre-molded compression-type, vulcanized, high grade compound gasket joints for 10" and larger pipe. Joint shall be in compliance with ASTM D3212.

D. Piping Support for Below Slab:

1. All below slab piping shall be supported by an engineered void system. VoidForm Products, Inc – PlumbingVoid or Supervoid Systems, LLC – Saddle Pipe Void System.
2. Void System Structure:

a. Provides a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes, including all imposed loads, throughout the construction process.
b. The system shall be designed to have the ability to temporarily position and suspend the lateral pipes to the specified height and slope until permanently anchored to the overhead structural slab via the securing hanger system. The open, underground system will then remain independent from the securing hangers.

c. The open space of the system beneath the structural slab is designed to receive the infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact with the soil, the uplifting soil pressure will become separate and allow the lateral pipes to be totally independent from the System.

3. Void System Material:

a. a. The system shall have waterproof components related to its intended performance
b. The system must maintain its structural integrity in all humid environments
c. The system must have industry-proven performance in any and all inclement conditions
d. The system shall be able to perform if and when submerged in water
e. It is recommended that all independent components not included in the system should comply with the project specifications in order to get the intended results of the designed system.
f. All vertical All-thread must have a component secured toward the top end and be permanently affixed into the concrete slab in order to maintain the specified elevations.
g. All System components, excluding All-thread, nuts/washers, shall be furnished by the designed, system manufacturer.
h. System shall be installed per the manufacturer's requirements and recommendations

4. Acceptable Manufacturer: VoidForm Products, Inc. – PlumbingVoid or Supervoid Systems, LLC – Saddle Pipe / Smart Void System.

2.2 CLEANOUTS

A. Acceptable Manufacturers:

1. Model numbers specified are products of Jay R. Smith, unless otherwise specified.
2. Other acceptable manufacturers:

a. Josam.
b. Wade.
c. Zurn.
d. Watts.

B. Size: Same size as pipe up to 4 Inches; 4 Inch for 4 Inch and larger pipe.

C. Cleanouts for Cast Iron Pipe: Tapped extra heavy cast iron ferrule, caulked into cast iron fittings.

D. Cleanout Plugs:

1. Meet requirements of Plumbing Code, with American Standard pipe threads.
2. Taper thread bronze plug
3. Or, gasket Seal bronze plug

E. Cleanouts do not require special covers on lines in completely accessible pipe chases or in equipment rooms where piping is exposed.

F. Pipe Fittings at Cleanouts: Make cleanouts turning out through walls and up through floor by long sweep ells or "Y" and 1/8 bends.

G. Cleanout Cover Plates:

1. Provide face or deck plates for concealed cleanouts to conform to architectural finish in room.
2. Where no definite finish is indicated, wall plates shall be stainless steel and floor plates Nickel Bronze.
3. Provide vandalproof screws.

H. Acceptable Products:

1. In floor with Linoleum tile or vinyl tile finish:

a. Round Nickel Bronze top.
b. Scoriated top.

c. Smith No. 4053L-NB-U.

2. In floor with ceramic tile finish:

a. Square Nickel Bronze top.
b. Scoriated top.
c. Smith No. 4053L-NB-U,

3. In finished rooms flush with wall:

a. Vandal Proof Stainless Steel Center screw.
b. Cleanout tee with Stainless Steel Round Cover.
c. Smith No. 4533-SS-U.

4. In fan or mechanical room floors with concrete finish and/or with floating floors:

a. Round Nickel Bronze Extra Heavy Duty top.
b. Secured Scoriated top.
c. Smith No. 4113L-NB-U.

5. In floors with carpet:

a. Continuous Carpet: Round Nickel Bronze top with Nickel Bronze Carpet Clamping Device (-X).
b. Carpet Squares: Round Nickel Bronze Scoriated top below carpet with screwed Stainless Steel Carpet Cleanout marker (-Y).
c. Smith No. 4033L-Y-NB-U or 4033L-X-NB-U.

6. For terrazzo floor finish:

a. Round Nickel Bronze top.
b. Scoriated top.
c. Smith No. 4053L-NB-U.

7. Exposed Stack:

a. Duco Coated Cast iron cleanout "tee".
b. Gasket Sealed countersunk bronze plug.
c. Smith No. 4513S-Y-U.

8. Underfloor Chase:

a. Cast Iron Cleanout body.
b. Gasket Sealed countersunk bronze plug.
c. Smith no. 4292L-U.

9. Vehicle Traffic Outside Grade:

a. Duco Coated Heavy Duty Cast Iron Round Cleanout Housing.
b. Soriated Cast iron Cover with Lifting Device.
c. Vandalproof screws.
d. Cast iron cleanout ferrule and Gasket Seal Bronze Plug.
e. Smith No. 4262L-U.

10. Grade:

a. Duco Coated Extra Heavy Duty Cast Iron Top.
b. Installed in concrete block 18" x 18" x 6", or surround each cleanout with a minimum of four inches (4") of concrete by six inches (6") thick, top of block shall be flush with finished grade.
c. Smith No. 4232L-U.

2.3 DRAINS

A. Acceptable Manufacturers:

1. Josam.
2. Jay R. Smith.
3. Wade.
4. Zurn.
5. Watts.

B. P-traps:

1. Provide floor and equipment drains with cast iron P-traps.
2. Provide deep seal traps where indicated, or as required.

C. Trap Primer Connections: Where indicated or shown on the drawings provide a trap primer connection on the body on the P-trap of each drain of the size indicated.

D. Clamping Collars: When installed with waterproofing membrane, or shower pans, provide floor drains with clamping collar.

E. Floor Drains/Sinks:

1. Floor Drain "FD-1" - For Finished Areas: Smith No. 2005-A06NB-U, cast iron body with cast iron collar, adjustable six inch (6") round secured satin finish bronze strainer, vandalproof screws, and bottom outlet. Provide Smith No. 3510-F1107NB cast iron body and cast iron collar, adjustable seven inch (7") round nickel bronze strainer, and four inch (4") round nickel funnel for drains that receive indirect waste piping from equipment or fixtures. Provide six inch (6") square top strainer size for Square Ceramic Tile Floors. Smith No. 2005-B06NB.
2. Floor Drain "FD-1A" - For Gang Shower Trench Drain: Same as FD-1 except with five inch (5") by 13" size nickel bronze strainer. Smith No. 2005-PNB.
3. Floor Drain "FD-2": Smith No. 2350 Duco coated cast iron body floor drain, adjustable eight point five inch (8.5") round top, loose set anti-tilting grate, perimeter drainage slots, flashing collar with weepholes, bottom outlet, and suspended sediment bucket. ProvideSmith No. 3650-B cast iron body with cast iron grate and collar six inches (6") round grate and 9" x 3-1/2" cast iron funnel for drains that receive indirect waste piping from equipment or fixtures.
4. Floor Sink "FS-1": Smith No. 3151Y cast iron body flanged floor sink with acid resistant coated interior and sediment bucket, minimum eight inches (8") deep, twelve inch (12") square top, double drainage flange, weepholes, bottom outlet, Nickel Bronze Rim and Secured Nickel Bronze 3/4 grate.
5. Floor Drain - “FD-3" - Jay R Smith 9710-C-U 8.5”" round stainless steel body with stainless steel drain, flashing clamp, weep holes, vandal-proof anti-tilt stainless steel grate and rim.
6. Hub Drain (H.D.): Set cast iron bell flush with finished surface, unless otherwise noted.

F. Provide deep seal cast iron traps with trap primer connections for all floor drains and hub drains that are served by T.P. lines routed below the slab or floor and cannot connect to T.P. connection on drain body.

G. Commercial Laundry Galvanized Roof Drain

1. Galvanized coated cast iron body with internal galvanized parts. Combined clamping and gravel stop; galvanized cast iron mushroom dome drain receiver, no hub outlet; flashing collar with underdeck clamp, adjustable collar, support ring, and vandalproof dome
2. Provide two stainless steel lint screens with galvanized angle iron slots for lint screens.
3. Acceptable Product: Josam 22010-20.

H. Trap Guards: Acceptable Manufacturer: ProSet Systems, Inc., or Jay R. Smith

1. Description:

a. Material: Smooth, soft, flexible, elastomeric PVC molded material molded into shape of duck’s bill, open on top with curl closure at bottom.
b. Allows wastewater to open and adequately discharge floor drain through its interior.
c. Closes and returns to original molded shape after wastewater discharge is complete.

2. Compliance:

a. ASME A112.6.3.
b. NSF/ANSI 14.
c. CSA B 79.

2.4 VENT PIPE ROOF PENETRATION FLASHING

A. Flash each vent pipe roof penetration as recommended by the roofing system manufacturer as specified under other sections of the specifications.

B. Where vent pipes pass through the roof and no indication is made elsewhere in other sections of the specifications as to flashing requirements, use 4 lb. per Sq. Ft. minimum; seamless sheet lead rolled over the vent pipe to counter flash pipe.

C. When lead flashing is required under the conditions noted in the above paragraph comply with the following:

1. 24 Inches square minimum size at base of lead flashing.
2. 8 Inches minimum clear on all sides of pipe.

D. Install vandalproof vent caps similar to Smith No. 1748 to be the same size as vent pipes passing through the roof.

E. Storm Shelter Vent Through Roof penetrations shall be RPH, LLC “Cyclone Vault” CVTR2000 series. Roof vents shall meet ICC-500 2014/FEMA P-361 with missile impact rating for 250+ mph. Vent shall be rust resistant secured on the underside of the roof deck with SILX4X gasket and flange. Contractor shall install per manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Each plumbing fixture shall be individually trapped and vented with vent and waste stacks full size throughout.
2. Install reducers, increasers, special flanges and fittings between piping and fixtures for complete installation, ready for use.
3. Make offsets necessary to avoid construction interferences.
4. Connect plumbing fixtures, drains, appurtenances, and appliances to receive or discharge liquid waste or sewage to sanitary waste system in accordance with requirements of local codes.
5. Protect seal of fixture trap in plumbing system with properly installed vent.
6. Coordinate floor drain locations with Drawings and other trades.
7. Manhole covers shall be sealed gas tight. Provide gasketted seal as recommended by manufacturer.

B. Slope:

1. Slope horizontal drainage lines 2 inches and smaller 1/4 In per foot toward main sewer.
2. Slope 3 inch and larger drainage lines 1/8 inch per foot
3. Horizontal drain lines shall be run in straight lines uniformly sloped.
4. Make changes in direction of flow of horizontal lines with wye and 1/8 bends.

C. Vents:

1. Extend vents above roof without reduction in size and terminate not less than 25 feet away from shaft, windows, or ventilating air intake openings.
2. All vent and branch vent pipes shall be graded and connected to drip back to sanitary waste pipe by gravity.
3. Extend vent lines at least 6 inches above flood level rim of vented fixture before offsetting.
4. Extend all vents minimum of 18 inches above roof.
5. Offset vents in outside walls to penetrate roof at least 18 inches from outside walls.
6. Extend roof vent flashing onto roof surface minimum of 8 inches on all sides in accordance with the roofing system manufacturer's recommendations.
7. Coat metal sheet flashing with bituminous mastic where in contact with mortar or concrete to prevent direct contact with masonry materials.

D. Traps:

1. Equip each fixture, floor drain or piece of equipment connected to sanitary waste system with a trap.
2. Plumbing fixtures, except those having integral traps, shall be separately trapped by water seal P-traps placed as close to the fixture outlet as possible.
3. Provide trap with cleanout.
4. No fixture shall be double trapped.

E. Cleanouts:

1. Cleanouts shall be installed per plumbing code in addition to those locations identified below.
2. Install in each change of direction greater than 90 degrees, at end of lines, base of risers, and other points necessary to permit cleaning of pipe sections.
3. Wall cleanout shall be provide on individual sinks, lavatories, and electric water coolers.
4. Cleanouts shall be readily accessible.
5. Extend cleanouts on concealed piping through and terminate flush with wall, floor, or grade. Strictly coordinate cleanout cover plate location with the Architect for approved locations prior to pipe installation.
6. Wall cleanouts shall be provided at restrooms, at a minimum, at the beginning and end of the chase wall Cleanouts located at water closets shall be set 12” above the flood rim of the water closet. Cleanouts located at urinals shall be set 6” above the flood rim of the urinal.
7. Provide additional cleanout as indicated in the documents and/or as required by owner and local AHJ.
8. Space cleanouts not more than 50 feet apart for 3 inch pipe or less and not more than 100 feet apart for 4 inch and larger pipe.
9. If local requirements are more stringent than those indicated herein then those shall govern.
10. Cleanouts located at restroom batteries and/or at water closets shall be installed 12 inches above the flood rim of the water closet.

F. Drains:

1. Install floor, area, and equipment drains flush in the floor or basin to be drained unless indicated otherwise.
2. Locate drains in mechanical equipment spaces to conform with drain locations of equipment furnished.
3. Coordinate drain locations for Food Service equipment with rough-in drawings for such.
4. Coordinate with other trades to insure floors are sloped toward floor or area drains to provide positive drainage.

G. Coordinate installation of vent flashing for all roof penetrations with other sections of the specifications.

3.2 FIELD QUALITY CONTROL

A. Furnish instruments, equipment, and labor necessary to conduct tests.

B. Test underground soil and waste piping before backfilling.

C. Test drainage, waste, and venting piping with water before fixtures are installed.

D. After plumbing fixtures have been set and traps filled with water, submit entire drainage, waste, and venting system to final test with smoke.

E. Water Test:

1. Apply water test to drainage, waste, and venting system either in its entirety or in sections.
2. If entire system is tested, tightly close openings in pipes except highest opening.
3. Fill system with water to point of overflow.
4. If system is tested in sections, each opening except highest opening of section under test shall be tightly plugged.
5. Fill each section with water and test with at least 10 foot head of water.
6. In testing successive sections, at least upper 10 feet of next preceding section shall be tested so that each joint of pipe in building except uppermost 10 feet of system has been subjected to test of at least 10 foot head of water.

7. Keep water in system or in portion under test for at least 60 minutes before inspection starts.
8. Repair any leaks discovered during test.
9. Repeat test until system holds water for six (6) hours without drop in water level.

F. Video Scoping:

1. Prior to start of construction, Contractor shall video scope the sanitary sewer mains. Any breaks, separations, bellies, or abnormality to sewer main shall be reported to the Birdville Independent School District Project Manager.
2. At the completion of construction, the Contractor shall video scope the sanitary sewer mains and provide copies of video scope to the Birdville Independent School District Project Manager.

G. Final Smoke Test: At the completion of project where new sanitary sewer piping is installed and/or existing sanitary sewer piping is modified, the entire sanitary sewer system for the facility shall be tested as indicated below. Birdville ISD construction manager shall be notified (2) days in advance of when the test shall occur. Contractor shall document testing procedures, start time and time of completion. This information shall be included into the O & M manuals as part of the final close out documents.

1. Produce smoke by smoke machine.
2. Maintain pressure equal to 1 inch water column for 15 minutes before inspection starts.
3. Repair leaks discovered during test.
4. Repeat test until system holds smoke for ten (10) minutes without showing leaks.

END OF SECTION

SECTION 22 14 00

STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 01 - General Requirements and referenced documents.

B. Comply with Division 22 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

1.2 SYSTEM DESCRIPTION

A. Provide a complete storm drainage system as indicated herein and as indicated on the contract drawings.

B. Provide an area drainage system within and to 5 feet outside building line or as otherwise indicated on the drawings.

C. Provide a subsoil drainage system as indicated herein and as indicated on the Contract Drawings.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 30 00.

B. Indicate on submittal piping material and joining method for each system and for the various sizes of piping systems to be installed. This shall be in tabular form in one location.

C. Product Data:

1. Pipe.
2. Fittings.
3. Joining methods.
4. Roof drains.
5. Area drains.

D. Certification: Submit certification that completed system complies with test requirements of municipality, State, and other public authorities having jurisdiction.

E. Provide closeout documents as required in Division 1, Section 01 17 00.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in following order of precedence:

1. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing.
2. Provisions specified in this Section.
3. International Plumbing Code.

B. Installer shall have been doing related work as described herein for a minimum of 5 years.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Above & below ground:

1. Schedule 40 PVC Piping:

a. Pipe 1-1/2 - 6 inches: Poly Vinyl Chloride (PVC) schedule 40, drain waste vent (DWV) pipe, ASTM D2466, ASTM D 2321, ASTM D2665 and ASTM 1785, NSF stamped and approved. System shall be rated for 200 psi minimum pressure.
b. Fittings 1-1/2 - 6 inches: Poly Vinyl Chloride (PVC) schedule 40, DWV patterned fittings, ASTM D2466 and ASTM 1784, NSF stamped and approved.
c. Solvent Cement: Shall comply with pipe and fitting manufacturer's recommendations and shall be a two (2) step process with Primer manufactured for thermoplastic piping systems and solvent cement per manufacturer and shall conform to ASTM D2564 and ASTM F656.
d. Anywhere non-plenum rated pipe is installed in return air plenums, all exposed portions of this pipe shall be covered with a plenum safe jacketing, or wrap, system per Insulation Specification 22 07 00 or use cast iron piping as specified above.

B. Piping Support for Below Slab:

1. All below slab piping shall be supported by an engineered void system. VoidForm Products, Inc – PlumbingVoid or Supervoid Systems, LLC – Saddle Pipe Void System.
2. Void System Structure:

a. Provides a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes, including all imposed loads, throughout the construction process.
b. The system shall be designed to have the ability to temporarily position and suspend the lateral pipes to the specified height and slope until permanently anchored to the overhead structural slab via the securing hanger system. The open, underground system will then remain independent from the securing hangers.
c. The open space of the system beneath the structural slab is designed to receive the infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact with the soil, the uplifting soil pressure will become separate and allow the lateral pipes to be totally independent from the System.

3. Void System Material:

a. a. The system shall have waterproof components related to its intended performance
b. The system must maintain its structural integrity in all humid environments
c. The system must have industry-proven performance in any and all inclement conditions
d. The system shall be able to perform if and when submerged in water
e. It is recommended that all independent components not included in the system should comply with the project specifications in order to get the intended results of the designed system.
f. All vertical All-thread must have a component secured toward the top end and be permanently affixed into the concrete slab in order to maintain the specified elevations.
g. All System components, excluding All-thread, nuts/washers, shall be furnished by the designed, system manufacturer.
h. System shall be installed per the manufacturer's requirements and recommendations

4. Acceptable Manufacturer: VoidForm Products, Inc. – PlumbingVoid or Supervoid Systems, LLC – Saddle Pipe / Smart Void System.

C. Subsoil Drain Pipe:

1. Corrugated, polyethylene perforated and non-perforated, high density corrugated pipe with internally smooth interior and drainage pattern fittings. Joints shall be made with split couplings, corrugated to insure a minimum of four corrugations, two on each side of the pipe joint.
2. ASTM D-1248
3. Provide a polyester envelope "sock" on the entire piping system.
4. Acceptable Product: Equal to Type N-12 pipe as manufactured by "ADS", Advanced Drainage Systems.

2.2 ROOF DRAINS

A. Acceptable manufacturers:

1. Model numbers specified are products of Jay R. Smith, unless otherwise specified.
2. Other acceptable manufacturers:

a. Josam.
b. Wade.
c. Watts.

B. Roof Drain (RD):

1. Duco coated cast iron body with combined clamping ring and gravel stop; no hub outlet; drain receiver with underdeck clamp, adjustable extension collar and vandalproof cast iron dome.
2. Acceptable product: Smith No. 1015Y-CID-C-R-U.

C. Emergency Overflow Roof Drain (OD):

1. Same as standard roof drains except with adjustable internal water collar for drains with (2") two inch - (6") six inch outlet, set not more than two inches (2") above the primary roof drain flood level or Same with cast iron external 2" two inch high clamping collar for drains with (8") eight inch and (10") outlet.
2. Acceptable product: Smith No. 1074Y-CID-C-R-U (2"-6" outlet) or No. 1080Y-AE-CID-C-R-U (8"-10" outlet).

D. Commercial Laundry Galvanized Roof Drain

1. Galvanized coated cast iron body with all galvanized parts. Combined clamping and gravel stop, no hub outlet and galvanized vandal proof dome.
2. Provide two stainless steel lint screens with galvanized angle iron slots for lint screens.
3. Acceptable Product: Smith No. 1010Y-G-CIDG-U.

2.3 DOWNSPOUT NOZZLE

A. Smith No. 1770, cast bronze downspout nozzle, loose wall flange and threaded connection.

2.4 DOWNSPOUT BOOTS

A. Downspout boots for connection to underground storm system shall be constructed of cast iron with one coat of rust inhibited primer applied at the factory, inlet shall match sheet metal gutter downspout dimensions, 6" diameter outlet, 60" long stock length.

B. Refer to Architectural Plans for quantities and installation details.

C. Secure boot per manufacturer's recommendations.

D. Acceptable Products: McKinley #DS2.

2.5 CATCH BASINS

A. Provide precast concrete catch basins where indicated and as detailed on the drawings.

B. Concrete shall be Class 1 with a minimum 4500 PSI design strength at 28 days and meet ASTM-C-913 and C-858 requirements. Structure shall be one monolithic pour.

C. Reinforcing steel shall be grade 60, No. 4 rebar spaced not more than twelve inches (12") on center each way. Rebar shall conform to ASTM A015.

D. Provide knockouts or pipe leave outs as required for drainage pipes indicated.

E. Provide cast iron frame and grating in sizes indicated on the drawings. Cast iron shall be gray cast iron conforming to ASTM A48-78, Class 35.

F. Structure and grating shall be designed for H-20 loading except when located in crawl spaces or as indicated otherwise.

G. Provide extensions as required to meet job requirements or where noted on the drawings.

H. Acceptable Products:

1. ParkUSA Equipment Co – CB12 or equal by
2. Oldcastle, Inc.
3. American Industrial Precast Products, Inc.

2.6 CLEANOUTS

A. Acceptable Manufacturers:

1. Josam.
2. Jay R. Smith.
3. Wade.
4. Watts
5. Zurn.

B. Size: Cleanouts shall be same size as pipe up to 4 Inches; 4 Inch for 4 Inch and larger pipe.

C. Cleanouts for Cast Iron Pipe: Tapped extra heavy cast iron ferrule, caulked into cast iron fittings.

D. Cleanout Plugs:

1. Meet requirements of Plumbing Code, with American Standard pipe threads.
2. Gasket Seal bronze plug.

E. Cleanouts do not require special covers on lines in completely accessible pipe chases or in equipment rooms where piping is exposed.

F. Pipe Fittings at Cleanouts: Make cleanouts turning out through walls and up through floor by long sweep ells or "Y" and 1/8 bends.

G. Cleanout Cover Plates:

1. Provide face or deck plates for concealed cleanouts to conform to Architectural finish in room.
2. Where no definite finish is indicated, wall plates shall be stainless steel and floor plates nickel bronze.
3. Provide vandalproof screws.

H. Acceptable Products:

1. In floor with Linoleum tile or vinyl tile finish:
   a. Round Nickel Bronze top.
   b. Scoriated top.
   c. Smith No. 4053L-NB-U.
2. In floor with ceramic tile finish:
   a. Square Nickel Bronze top.
   b. Scoriated top.
   c. Smith No. 4053L-NB-U,
3. In finished rooms flush with wall:
   a. Vandal Proof Stainless Steel Center screw.

b. Cleanout tee with Stainless Steel Round Cover.
c. Smith No. 4533-SS-U.

4. In fan or mechanical room floors with concrete finish and/or with floating floors:

a. Round Nickel Bronze Extra Heavy Duty top.
b. Secured Scoriated top.
c. Smith No. 4113L-NB-U.

5. In floors with carpet:

a. Continuous Carpet: Round Nickel Bronze top with Nickel Bronze Carpet Clamping Device (-X).
b. Carpet Squares: Round Nickel Bronze Scoriated top below carpet with screwed Stainless Steel Carpet Cleanout marker (-Y).
c. Smith No. 4033L-Y-NB-U or 4033L-X-NB-U.

6. For terrazzo floor finish:

a. Round Nickel Bronze top.
b. Scoriated top.
c. Smith No. 4053L-NB-U.

7. Exposed Stack:

a. Duco Coated Cast iron cleanout "tee".
b. Gasket Sealed countersunk bronze plug.
c. Smith No. 4513S-Y-U.

8. Underfloor Chase:

a. Cast Iron Cleanout body.
b. Gasket Sealed countersunk bronze plug.
c. Smith no. 4292L-U.

9. Vehicle Traffic Outside Grade:

a. Duco Coated Heavy Duty Cast Iron Round Cleanout Housing.
b. Soriated Cast iron Cover with Lifting Device.
c. Vandalproof screws.
d. Cast iron cleanout ferrule and Gasket Seal Bronze Plug.
e. Smith No. 4262L-U.

10. Grade:

a. Duco Coated Extra Heavy Duty Cast Iron Top.
b. Installed in concrete block 18" x 18" x 6", or surround each cleanout with a minimum of four inches (4") of concrete by six inches (6") thick, top of block shall be flush with finished grade.
c. Smith No. 4232L-U.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install roof drains, reducers, increasers, flanges, and fittings between piping and drains in accordance with manufacturer's recommendations.
2. Make offsets necessary to avoid construction interferences.
3. Protect piping from damage and corrosion.
4. Connect drains receiving water to storm drain system of building.
5. Coordinate precast trench and other types of grating system installations with Drawings.
6. Horizontal pipe and fittings six inches (6") and larger shall be suitably braced to prevent horizontal movement. This shall be done at every branch opening or change of direction by the use of braces,

blocks, rodding, or other suitable methods, to prevent movement. Consult pipe manufacturer's recommendations for approved methods.

B. Slope:

1. Horizontal drainage lines 2 inches and smaller: Slope minimum 1/4 inch per foot toward main sewer.
2. Horizontal drain lines 3 inches and larger: Slope minimum 1/8 inch per foot toward main sewer.
3. Run horizontal drain lines in straight lines at uniform slopes.
4. Make changes in direction of flow of horizontal lines with Y and 1/8 bends.

C. Cleanouts:

1. Install in each change of direction 90 Degrees or greater, end of lines, base of risers and other points necessary to enable cleaning out of pipe sections.
2. Cleanouts shall be readily accessible.
3. Extend cleanouts on concealed piping through and terminate flush with wall, floor, or grade.
4. Cleanouts shall be not more than 50 feet apart for 3 inch and smaller pipe, and not more than 100 feet apart for 4 inch and larger pipe.

D. Insulation:

1. Provide insulation on body and piping of roof drains and overflow drains, per Section 22 07 00.

E. Perforated subsoil drain piping shall be installed in continuous length around perimeter of building and tee into non-perforated subsoil drain line and drained to sump.

3.2 FIELD QUALITY CONTROL

A. Furnish instruments, equipment, and labor necessary to conduct tests.

B. Methods of sampling, inspecting, and testing shall conform to local codes.

C. Test underground storm drainage piping before backfilling.

D. Test storm drainage piping with water.

E. Submit drainage system to final test with smoke.

F. Water Test:

1. Apply water test to entire system or in sections.
2. If entire system is tested, tightly plug openings in pipes except highest opening.
3. Fill system with water to point of overflow.
4. If system is tested in sections, tightly plug openings except highest opening of section under test.
5. Fill section with water to 10 foot head of water.
6. In testing successive sections, upper 10 feet of next preceding section shall be tested so that each joint of pipe in building except uppermost 10 feet of system has been subjected to test of 10 foot head of water.
7. Keep water in system or in portion under test for one hour before inspection starts.
8. System shall than be made tight at all joints.
9. Repair leaks.
10. Repeat test until system holds water for six hours without drop in water level.

G. Final Smoke Test:

1. Produce smoke by smoke machine with pressure equivalent to 1 inch water column maintained for 15 minutes before inspection starts.
2. Repair leaks.
3. Repeat test until piping system holds smoke ten minutes without showing leaks.

END OF SECTION

SECTION 22 21 13

PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 22 Sections, as applicable. Refer to other divisions for coordination of work with other portions of Work.

1.2 SYSTEM DESCRIPTION

A. Furnish and install all piping of every kind required, specified, or shown on the Drawings for the installation of the work specified in Division 22. The location, direction, and size of the various lines are indicated on the Drawings. Lines for pilot and controls and instrumentation are not shown but shall be installed as required and as specified.

B. Piping systems shall include all appurtenances shown on the drawings and specified herein.

C. Valves or cocks shall be installed to control the flow of water to each of the various systems, to segregate individual items of equipment and parts of fluid circulating or supply systems, and to permit draining of systems or portions thereof, to blow-off strainers, etc., as directed on the Drawings and specified.

D. The work shall include the furnishing and installing of all supporting structures and members for pipes, ducts, and equipment.

E. Support devices and members shall include vibration and noise isolating devices and assemblies. Penetrations of walls to structure shall be sealed off to limit noise transmission through sleeves.

F. All material shall be manufactured in the United States and/or shall comply with the North America Free Trade Agreement, NAFTA.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality.

B. All equipment and materials shall be installed by experienced mechanics certified and trained for the work performed.

1.4 SUBMITTALS

A. Product Data: Submit complete manufacturer's descriptive literature and installation instructions in accordance with Section 01 33 00 for all piping materials to be used for each system, valves and plumbing specialties as specified herein.

B. Shop Drawings:

1. Submit in accordance with Sections 01 33 00 and 22 05 00.
2. Submit 1/4" = 1'-0" Plumbing Piping Shop Drawings.
3. Overlay piping Shop Drawings over other Shop Drawings of other trades to include electrical and sheet metal Shop Drawings.
4. Plan views of congested areas and sections thereof shall be drawn at a scale of 3/8" = 1'-0".

5. There is a minimum $150.00 fee, payable to the engineer to obtain Auto Cadd files for this purpose. A “Release of Liability” form must be signed after which a single CD will be produced when payment is received.

C. Fully coordinate all piping shop drawings with sheet metal shop drawings and other trades. Failure to submit shop drawings in a timely manner, as required to keep pace with the construction and work of all other trades, will result in delays, and possible stoppage, of payment to the Contractor. Additionally, no work may proceed until such shop drawings are submitted, reviewed, and found to be acceptable by the Engineer.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Storage and protection of materials shall be in accordance with Section 22 05 00.

C. Take special precautions to protect control valve internals from construction dirt and debris. If valves are stored on site cover valve openings until just prior to installation but in no case shall valves be unprotected for more than 48 hours.

D. Openings in piping system, boilers, pumps, valves and other heat exchangers shall be covered during the construction period to protect the interior accumulation of dirt and debris in these systems until immediately prior to connection to these components to similarly protected systems.

PART 2 - PRODUCTS

2.1 FLANGES

A. Flanges in welded lines for water systems shall be 150 pound forged steel, welding neck flanges, except where cast iron fittings are used as specified elsewhere in these specifications, and except as otherwise shown.

B. Flanges in screwed ferrous lines shall be 125 pound cast iron or 150 pound forged steel screwed flanges.

C. Where ferrous flanges connect to flat faced flanges on valves, items of equipment, etc., the companion flange shall be flush faced and where the flanges on items of equipment are raised face flanges, the companion flanges shall have raised faces.

D. Flanges in copper lines shall be solder joint type cast brass flanges.

E. Flange bolts and nuts shall conform to the applicable requirements of the latest edition of the Code for Pressure Piping.

F. Slip-on welding neck flanges are prohibited.

G. Flanges shall be Weldbend, Tube Turn, Hackney, or approved equals.

2.2 GASKETS

A. Install gaskets between flanges of all flanged joints. Where used with brass or bronze flanges or with flat face ferrous flanges, they shall be full face type. For all other flanges they shall be ring gaskets properly cut to fit within the inside edges of the bolts.

B. Gaskets in water lines shall be Garlock No. 24 Wire Insertion Red Rubber Sheet Packing, 1/16" thick and for any other systems use special materials suitable for the duty as recommended by their manufacturer.

2.3 INSULATING FITTINGS

A. Except that no dielectric fitting shall be installed in connections between copper or brass and sanitary cast iron waste, drain and vent lines, wherever an interconnection is made between ferrous pipes or vessel and copper tubing or brass pipe, or vice versa, install a dielectric fitting.

B. In lines assembled with screwed or soldered joints, use insulating couplings (unions) suitable for the intended service and where flanged connections are required, use insulating gasket material between flange faces, insulating grommets between bolts and holes in flanges and insulating washers under both bolt heads and nuts.

C. PVC couplings of any kind shall not be acceptable for insulating couplings.

D. Insulating fittings shall be suitable for the service medium, operating pressure and temperature. Fittings shall be rated for 1.5 times the normal system operating temperature and pressure in which installed.

E. Insulating fittings shall be as manufactured by EPCO, Maloney, or Crane.

2.4 VALVES

A. All valves of any one type shall be of the same make throughout and insofar as practicable all valves in a given category shall be of the same make.

B. All valves shall be so located as to be readily accessible for operation and maintenance.

C. Furnish and install all valves indicated on the Drawings, specified herein, and required to control the flow of water to and from various parts of the systems and to isolate various pieces of machinery and equipment and to isolate various parts of the systems.

D. Each valve for installation in a line to be insulated shall have sufficient clearance between the valve body and the operating handle or device to accommodate the insulation.

E. All valves shall be designed for re-packing under pressure when fully opened and shall be equipped with packing suitable for the service.

F. Valves shall generally be installed with stems up; but, in no case, less than horizontal and whenever possible shall be grouped together in a uniform manner.

G. Except where special valves are specified elsewhere herein or as required by special conditions or class of work, valves shall be equivalent to the following Nibco Co.valve numbers listed herein.

H. All valves used for domestic water service shall be Lead-Free per the “Safe Drinking Water Act”. U.S. Senate Bill S. 3874.

I. All Lead Free globe valves 2" and smaller shall be Class 150 rated to 200 degrees F. or Class 300 rated for 300 degree F and below.

1. Valves shall have rising stem, screwed or union bonnet and manufactured in accordance with MSS-SP-80.
2. Body and bonnet shall be manufactured of ASTM B-62 alloy or ASTM B-61 alloy.
3. All valves shall have ductile or malleable iron handwheels.
4. Stems shall be made of dezincification resistant silicon bronze ASTM B-371 or be low zinc alloy B-99.
5. All valves shall be supplied with non-asbestos packing, amarid fibers or approved equal.
6. Where higher operating pressures approach 300 PSI, Class 300 Union bonnet valves of similar construction shall be used.
7. All valves 2-1/2" and larger shall be Class 125WP and 200WOG rated for 200 degrees F., be the flanged design, have bronze trim, and have an outside screw and yoke design.
8. Class 150 valves shall be one of the following:

a. Nibco - T-235-Y.
b. Apollo – 122T.
c. Jenkins - 106BJ.
d. Hammond IB413-T.

9. Class 125 valves shall be one of the following:

a. Nibco - F-718-B.
b. Apollo – 711F
c. Jenkins - 2342J.
d. Hammond IR116.

10. Class 300 valves shall be one of the following:

a. Nibco - T-276-AP.
b. Apollo – 128T
c. Jenkins - 592J.
d. Hammond IB444.

J. Where cocks are required, they shall generally be brass, screwed pattern up to 2" and cast iron flanged pattern 2-1/2" and larger plug cocks suitable for the system pressure. Also provide and install all special cocks required such as pet cocks, gauge cocks, etc.

K. Provide Lead Free plug valves where indicated, at "all water balance stations" and at all pump discharges.

1. In no case shall butterfly or ball valves be substituted for plug valves where plug valves are indicated on the Drawings.
2. Valves shall be flanged-type, 2-1/2" and larger, and threaded 2" and smaller.
3. Plug valves 4" and smaller shall be equal to DeZurik Series 400 eccentric plug valves with cast iron bodies.
4. Plug valves over 4" in size shall be equal to DeZurik Series 100 eccentric plug valves with cast iron bodies.
5. Valves 4" or smaller shall have cast iron bodies with bronze plugs on sizes 2" and smaller and electroless nickel plated cast iron plugs on 2-1/2" to 4" valves.
6. Valves over 4" shall have cast iron bodies with stainless steel plugs and bearings.
7. All plugs shall have resilient faces rated for water temperatures up to 250 Deg.F. and stem seals meeting the same temperature rating. For general chilled and heating water applications, elastomeric coating shall be EPDM.
8. Furnish lever operator for all valves except at water coils of terminal units where snap-on plastic caps shall be furnished.
9. All valves shall have adjustable memory stops with plastic drip caps.
10. Plug valves shall be furnished with drilled and tapped 1/8" openings for pressure gauge connections at both upstream and downstream sides.
11. Plug valves shall be bubble tight with 150 pound differential pressure across the seat.
12. An indicator shall be included to show valve position.
13. All flanged plug valves shall have bolted bonnets.
14. All valve seats shall be welded in nickel for plug valves over 4" in size.
15. Plug valves shall be as manufactured by:

a. SMG.
b. McDonald.
c. Rockwell-Nordstrom.
d. Milliken.

L. Lead Free Check valves in pump discharge lines shall be flanged non-slam type silent check valves. Valves shall have a bronze body and be bronze fitted with stainless steel springs. Valves shall be rated for 125 PSIG WOG and be one of the following products:

1. Nibco - 480 Series, or equal by
2. Apollo 61LF-100.

3. Hammond UP943 or UP947.

M. Lead Free Swing Check Valves 2" and smaller shall be the Y-pattern swing-type manufactured in accordance with MSS-SP 80, and be Class 125 rated to 200 degrees F or below, have bronze ASTM B-62 bodies with bronze discs. Swing check valves 2" and smaller shall be of the following:

1. Nibco - T/S-413-B.
2. Apollo 161 T/S-LF.
3. Milwaukee UP509 or UP1509.
4. Hammond - UP904 or UP912.

N. Lead Free Swing Check valves 2-1/2" and larger shall be the swing-type manufactured in accordance with MSS-SP71, be Class 150 rated for 200 degrees F. or below, be flanged, have ASTM A126, Class B, cast iron bodies with bronze trim, and have non-asbestos gaskets. Swing Check valves 2-1/2" and larger shall be one of the following:

1. Nibco - S-433-B, or equal by
2. Apollo.
3. Milwaukee.
4. Hammond.

O. Bronze Lead-Free Ball valves: 2” and Smaller:

1. Ball valves shall be on the following products:
    a. Nibco T-585-66-LF or S-585-66-LF.
    b. Apollo 77CLF-140 Series.
    c. Hammond UP8301A or 8311A.
2. Ball valves may also be used in lieu of plug valves for balancing purposes for lines 2" and smaller and only when provided with memory stops.
3. Ball valves shall be full port design with stainless steel ball and stem.
4. All ball valves shall be manufactured from a dezincification resistant material with less than 15% zinc.
5. Provide memory stops where used for balancing or as shown and where detailed.
6. Provide extended lever handles for all valves installed in insulated lines.
7. Ball valves installed on water piping shall be provided with an extended "T" handle with insulation insert and collar that creates a vapor seal to prevent condensation while allowing adjustment of memory stops and valve packing maintenance without disturbing the insulation. Insulated "T" handles shall be equal to Nib-Seal as manufactured by NIBCO. No extended metal handles are allowed.

P. Flanged FDA Approved Lead-Free Ball valves: 2½” and Larger:

1. Ball valves shall be on the following products:
    a. Watts G4000M1.
    b. Apollo 77CLF-140 Series (2 ½”).
    c. Apollo 6PLF
2. Ball valves shall be full port design with stainless steel ball and stem.
3. Ball valves shall be manufactured with FDA approved epoxy coating.

Q. Lead Free Manual Balancing Valves

1. Valves shall be cast bronze body with stainless steel ball construction with glass and carbon filled TFE seat rings tapped purge port, memory stops, calibrated name plate, with positive shut-off, provide Bell & Gossett “Circuit Setter Plus” or equal by ARMSTRONG, NIBCO & DANFOSS shall have differential pressure read-out ports across the valve seat. Read-out ports shall be fitted with internal EPT check valves.

R. Lead Free Automatic Balancing Valves

1. ThermOmegaTech – “Circuit Solver Assembly” CSUA or CSUA-PP with integral spring check valve. Stainless steel self-contained fully automatic thermal flow control device. Assembly shall be provided with lead-free full port bronze ball valves, integrated union and internal spring check valve.

S. Provide Venturi splitter valve with integral isolation valves, unions, EPDM seals at locations within the domestic hot water supply system to maintain domestic hot water loop temperatures and supply within required distances as listed with the IECC. Acceptable product: Kemper – KHS-650-02 Series.

T. All valves, valve packing material, gaskets, pipe threading compound, etc., shall be compatible with ethylene glycol, without exception. Typically, use EPDM valve packing materials. No teflon materials are allowed. Indicate compliance on submittals.

2.5 PIPE HANGERS

A. Pipe hangers, except for fire protection types, shall be as manufactured by Anvil International, Inc. and be of a type suitable for each use. Approved equals by Mason Industries, Inc., B-Line, Grinnell, and PHD Manufacturing, Inc. will be considered.

B. For cast-iron pipes up to three inches (3") in size, use Anvil Fig. 104 malleable iron, adjustable, split ring, swivel hanger, or Anvil Fig. 590 steel clevis hanger. For cast iron plumbing piping four inches (4") and larger, use only Anvil Fig. 590 steel clevis hanger.

C. For PVC, CPVC, PVDF, Polyproplene pipe sizes up to three inches (3") ini size, use Anvil FIG. 104 malleable iron, adjustable, split ring, swivel hanger, or Anvil FIG. 590 Steel Clevis hanger. For sizes four inches (4") and larger, use only Anvil FIG. 590 Steel Clevis hanger.

D. Domestic cold and hot water piping 3/4" in size up to and including twelve inches (12"), shall be Anvil Fig. 260, adjustable clevis hangers. Hangers shall be sized to be on the outside of the insulation.

E. Where several pipes are routed parallel to each other and at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where rollers are called for elsewhere by these specifications.

F. For bare copper pipes (uninsulated only) up to and including three inches (3") in size, use Anvil Fig. CT-109 malleable iron, copper plated, split ring, hangers or Anvil Fig. CT-65 copper plated clevis hangers. For uninsulated copper pipes larger than three inches (3"), use Anvil Fig. CT-65 copper-plated clevis hanger.

G. Hanger rod sizes shall conform to the following schedule:

Pipe up to, and including 2"	3/8" rods
Pipe 2-1/2", 3", and 3-1/2"	1/2" rods
Pipe 4" and 5"	5/8" rods
Pipe 6"	3/4" rods
Pipe 8", 10" and 12"	7/8" rods
Pipe 14", 16" and 18"	1" rods
Pipe 20" up to 30"	1-1/2" rods

H. Unless shown otherwise on the Drawings, all horizontal runs of steel piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing:

Pipe up to, and including 1-1/4"	8 feet
Pipe 1-1/2" and 2"	10 feet
Pipe 2-1/2" and 3"	12 feet
Pipe 3-1/2" and 4"	12 feet
Pipe 5" and 6"	*8 feet
Pipe 8" and larger	*8 feet
* Maximum 8 foot spacing for pipe supports for pipes 5" and larger due to structural considerations.	

I. Unless shown otherwise on the Drawings, all horizontal runs of cast-iron piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing:

Pipe up to, and including 1-1/4"	5 feet
Pipe 1-1/2" and 2"	*5 feet
Pipe 2-1/2" and 3"	*5 feet
Pipe 3-1/2" and 4"	*5 feet
Pipe 5" and 6"	*5 feet
Pipe 8" and larger	*5 feet
* Maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.	

J. Unless shown otherwise on the Drawings, all horizontal runs of “Poly” thermoplastic type piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing:

Pipe up to, and including 1-1/4"	4 feet
Pipe 1-1/2" and 2"	4 feet
Pipe 2-1/2" and 3"	4 feet
Pipe 3-1/2" and 4"	4 feet
Pipe 5" and 6"	4 feet
Pipe 8" and larger	4 feet

K. Unless shown otherwise on the Drawings, all horizontal runs of copper piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing:

Pipe up to 3/4" in size	6 feet
Pipe 1" and 1-1/4"	8 feet
Pipe 1-1/2" and 2"	10 feet
Pipe 2-1/2" and larger	12 feet

L. There shall be a hanger within two feet (2') for any ferrous or copper piping and eighteen inches (18") for any “poly” thermoplastic type pipe of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps. Vertical pipes within a space shall have not less than two (2) supports. Where the vertical run of pipe in a space exceeds 14 feet then three (3) supports shall be required.

M. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting; nor shall it be supported from equipment connections.

N. Inserts shall be used where piping or equipment is to be hung from concrete construction. Inserts shall be Anvil Fig. 281, wedge type, concrete inserts. All inserts shall be pre-treated to prevent rusting. After the forms are removed, clip off all nails flush with the exposed surface of the inserts.

O. Expansion bolts shall be Ackerman-Johnson.

P. Beam clamps suitable for the use with the type of steel construction involved shall be an Anvil product or an approved equal as indicated elsewhere herein.

Q. No perforated straps shall be used to support any mechanical equipment item or piping of any kind.

R. Potable and non-potable domestic cold water, domestic hot water (includes recirculated lines), horizontal and vertical storm drain downspouts and soil piping receiving cold condensate piping hangers shall be sized to go around the insulation with shields being provided to protect the insulation. Shields shall be Anvil Fig. 167.

S. All steel hangers, base plates, supports, nuts, bolts, and all thread rod located outdoors, in crawl spaces, and exposed to the weather, shall be made of galvanized steel or equally suitable corrosion resistant steel alloy or aluminum. Where steel components are allowed and used under these conditions they shall be painted with an equivalent protective coating similar to a two-part epoxy. Refer to Section 09 90 00.

T. For pipe sizes 8" and under use Anvil Fig. #93 and 94 beam clamps. For pipe sizes 10" through 18" use Anvil Fig. #66 in the “U” position.

2.6 SLEEVES AND ESCUTCHEONS

A. Generally where pipes pass through interior building walls or floors above the first floor (out of the ground), 22 gauge galvanized sheet metal sleeves shall be used. Sleeves shall extend a minimum one inch (1") above a floor or beyond the wall, as applicable.

B. All pipes penetrating grade beams, exterior walls, concrete structural members, or concrete slabs of mechanical equipment rooms on the first floor shall generally use standard weight galvanized steel pipe as the sleeving material.

C. For concrete or masonry walls, sleeves shall be inserted into the masonry, decking or form work prior to the pouring or placement of concrete or masonry units to create a leave out.

D. The sizes of all sleeves shall be such as to permit the subsequent insertion of the intended pipe of the proper size with adequate clearance for movement due to expansion and contraction. In the case of insulated lines, the diameter of the sleeves shall be at least 1/2" greater than the outside walls of the pipe with specified thickness of insulation. This will require that the inside diameter of galvanized steel pipe sleeves be at least 1/2" greater than the outside diameter of the service pipe with insulation. Galvanized steel pipe sleeves set in floors shall project two inches (2") above the floor.

E. After the pipes are installed, fill the annular space between the pipe, and insulation as required, and its sleeve with an approved mastic or caulk. Use loose fibrous insulation packing as required to accomplish this. In all cases the annular spaces around the pipes within the sleeved openings shall be filled with loose fibrous insulation and then sealed with an approved caulking or expanded foam insulation.

F. Escutcheons, except as specifically noted or specified, shall be installed on all pipes passing exposed through floors, walls, or ceilings. Escutcheons shall be equal to the Crane No. 10, chrome plated sectional floor and ceiling plates, and shall fit snugly and neatly around pipe or pipe insulation or insulated lines. Solid chrome plates with set screws shall be used if sectional plates do not fit properly or stay in place. Where multiple pipes penetrate floors or walls in close proximity in concealed areas, shop made sheet metal escutcheons may be used.

G. Pipes sleeved through grade beams open to basements, crawl spaces or void spaces below grade shall additionally receive "Link Seal" or equal closures made of interlocking synthetic rubber links. Seals shall provide for absolute water tightness. Seal shall be constructed to insulate electrically pipe from wall. Install as recommended by manufacturer. Provide Century-Line sleeves with water stop and anchor collar for pipes penetrating grade beams designated to be anchored.

H. Where PVC pipes, 3 inches and smaller, and small copper water piping under 2 inches in size, penetrated a horizontal floor slab a metal sleeve will not be required. For these piping systems, completely wrap the piping with a polyethylene tape, or wrapping. This tape shall be minimum 4 mils thick and shall be wrapped at least two times around the pipe and secured sufficiently to hold the wrap in place during the pouring of the slab. This wrap shall be in sufficient length or height to insure that no concrete will be in contact with the pipe. All other piping shall be sleeved as indicated elsewhere herein.

I. Refer to Section 22 05 00 for additional requirements of penetrations through fire-rated assemblies.

2.7 ACCESS DOORS

A. Wherever access is required above inaccessible ceilings, in walls, furrings, chases or soffits to physically reach concealed piping, or equipment installed under Division 22, provide access doors of sufficient size to maintain, repair, replace or suitably access devices intended to be adjusted as indicated herein.

B. Provide an access door or panel for each of any valves, group of valves, damper pull rods, splitter dampers, manual volume dampers, actuators or other controlling mechanism installed under Division 22 which would otherwise be concealed in the building construction with no access.

C. All access doors in toilet rooms, locker rooms, showers, kitchens, or other similar wet areas shall be the flush mounted type and be made of brush or satin finish stainless steel as manufactured by Milcor or ELMDOR.

D. All access doors shall be minimum 18" x 18", unless noted otherwise, in size unless otherwise approved in writing in advance by the Engineer. Doors shall be increased in size as required to allow for a person to reasonably access, adjust, maintain, service, inspect or replace the largest single component concealed. Provide special sizes of access doors as required.

E. Coordinate the final location of all concealed equipment and devices requiring access with the final location of the required access panels or doors. Allow ample space for the removal of all parts and equipment that require replacement or servicing.

F. Where mounting heights are not detailed or dimensioned, install mechanical piping and overhead equipment to provide the maximum headroom possible while maintaining reasonable access and service to those items being accessed.

G. All serviceable equipment shall be within immediate reach (maximum of 12") from the access door.

H. Install all access doors in locations to suit the intended purpose but have each location reviewed and approved by the Architect. In no case shall access doors be located such that the intended purpose is rendered useless.

I. Access doors shall all have spring concealed hinges, screwdriver operated cam latches, be the flush mounted type, open up to, but not more than, 175 degrees, be made of steel, or stainless steel to suit the application, be fire rated (U.L. rated) to match the rating of the surface where the door is placed, and have a powder coated electrostatic primer paint on all steel doors. Furnish the following access door types as described below:

1. Milcor Style DW - Flush drywall type with frame made of 16 gauge steel, panel door made of 14 gauge steel, galvanized steel drywall bead on frame, and removable hinge pins for removal of panel door. Provide minimum of two hinges (12" x 12" and larger) up to 24" x 24" in size and three hinges on access doors above this size. Provide one cam for access doors 14" x 14" and smaller and a minimum of three cams on larger sizes.
2. Milcor Style K - Flush plaster wall or ceiling type made similar to Style DW except with a 22 gauge expansion casing bead, one hinge on 12" x 12" access doors, two hinges on larger doors with either side no larger than 24", three hinges on doors with any dimension of 24" or larger, minimum one cam on doors with no dimension larger than 18" and two or more cams on larger access doors.
3. Milcor Style M or MS - Flush drywall, masonry or tile type made similar to Style DW except with 14 gauge steel frame and doors (16 gauge when made of stainless steel-satin finish), one hinge on access doors up to 18" x 18" in size, two hinges on sizes 20" x 24" and 22" x 22", three or more hinges on sizes 24" x 24" and larger, and the number of cams as standard with the manufacturer.
4. Provide other types of access doors suitable for the application to include surface mount, double leaf for access doors exceeding 36" in any dimension, louvered where indicated on the Drawings, fire rated, recessed or security/detention types as required and compatible with the surface penetrated.
5. Acceptable manufacturers: ELMDOR or Milcor.

2.8 STRAINERS

A. Strainers shall be of the FDA approved, heat fused epoxy coated (interior and exterior) "Y" pattern type bodies, unless shown or specified otherwise. Body ends shall be screwed or flanged to match the type of joints in the piping in which the strainers are installed. Strainers shall have a 200 psi non-shock, ANSI B16.1 pressure rating. Watts 77F-DI-FDA-125, or Engineer approved equal.

B. Each strainer, screen, or mesh shall be of Type 304 Stainless steel, brass, or monel construction. Screen or mesh sizes shall be as scheduled below:

Pipe Size	Screen/Mesh Size
1/2" - 2"	20 Mesh
2-1/2" - 3"	0.045 Perforations
4" - 12"	0.125 Perforations

C. Where vertical space does not permit the installation of the "Y" strainer, install an equivalent basket strainer.

D. Strainers shall be of the FDA approved, heat fused epoxy coated (interior and exterior) “Y” pattern type bodies, unless shown or specified otherwise. Body ends shall be screwed or flanged to match the type joints in the piping in which the strainers are installed. Strainers shall have a 200 psi non-shock. ANSI B16.1 pressure rating. Watts 77F-DI-FDA-125, or Engineer approved equal.

E. Lead Free Bronze Strainers for screwed piping shall be Watts LF777 Series (cast bronze body) with bronze plug stainless steel mesh strainer for copper piping; piping shall be Watts CI-125 or F-125 and CI-250 or F-250 (cast iron bodies). Equivalent as manufactured by the following will be considered:

1. Nibco.
2. Hammond.
3. Apollo.
4. Milwaukee.

2.9 GAUGES AND GAUGE COCKS OR NEEDLE VALVES

A. Provide the following pressure gauge cock or needle valve connections:

1. At the suction and discharge of each pump.
2. At the domestic water riser, downstream of main isolation value.
3. Downstream of the building main backflow preventer.
4. At the inlet and outlet of pressure reducing stations.
5. At circuit setter balance stations and any other points indicated or detailed on diagrams on the Drawings.
6. At the inlet and outlet of circulation pumps.

B. Where gauge connections are installed in insulated lines, install gauge cocks or needle valves on a nipple of sufficient length that the gauge cock or needle valve handle will be free of the pipe insulation. Position each gauge cock in relation to surrounding piping and equipment so that the gauge may be easily read and so that a gauge having a 4" diameter dial can be screwed into and out of the piping nipple where the gauge cock or needle valve is installed. All gauge cocks shall be of the tee-handle type. Needle valves shall be a Weksler AV32, AV34, or BBV4.

C. Install gauge cocks or needle valves at pumps at the pump suction and discharge flange connections at the pre-drilled and tapped gauge connections as provided by pump manufacturer.

D. Furnish and install a pressure gauge suitably calibrated at each of the following locations:

1. At the suction and discharge of each pump.
2. At the domestic water riser, downstream of main isolation value.
3. Downstream of the building main backflow preventer.
4. At the inlet and outlet of pressure reducing stations.
5. At circuit setter balance stations and any other points indicated or detailed on diagrams on the Drawings.
6. At the inlet and outlet of circulation pumps.

E. Gauges shall be of the bourdon tube type, glycerin filled, and shall be selected to operate at about the midpoint of their full range, i.e., for a 50 PSI operation, select a gauge of 0 to 100 psi. Each gauge shall be provided with a brass lever handle union cock or brass handle needle valve. Cases shall be Stainless Steel, not less than four inches (4") in diameter.

F. Pressure gauges shall be equal to Weksler Model 401L-4-PD with type ASD case, phosphor bronze with phosphor bronze brushed rotary movement and link; 4" dial, nickel plated ring, free standing stainless steel case; equipped with micrometer adjustment pointer. Provide each gauge with scale range suitable for the duty.

G. Provide pulsation dampeners, adjustable snubbers, or piston type pressure snubbers in line with all pump gauges.

H. Cocks and gauges shall be manufactured by:

1. Crosby.
2. Weksler.
3. Marsh.
4. Trerice.
5. Miljoco.
6. Weiss.

2.10 THERMOMETERS AND THERMOMETER WELLS

A. Furnish and install brass or stainless steel closed separable thermometer wells for all thermometer and controller bulbs which are designed for liquid measurements. Whenever a thermometer or controller bulb is inserted in a pipe for either remote or local temperature indication or control, locate the thermometer well so that it will be completely surrounded by flowing fluid. Such thermometer locations as are shown on the Drawings are diagrammatic only. Install thermometer wells for maximum effectiveness and in the case of locally indicating instruments, for easy readability.

B. Supply each brass test well for use with the stem thermometers, a threaded brass plug and keeper chain. Install these test wells in the following locations such that they can be filled with oil to facilitate temperature measurements:

1. At the inlet and outlet of each water coil.
2. At the inlet and outlet of each heat exchanger, evaporator and condenser.
3. At the discharge of each modulating 3-way control valve.
4. At other locations as specified herein or shown on the Drawings.

C. Where thermometer wells are called for, furnish and install brass wells with the tip of the well extending into the water stream. The well shall have a plug attached to it with a short length of chain. The wells shall be installed in the vertical or at 45 degree angle up.

D. Thermometers shall be of the industrial type with red spirit filled liquid (no mercury allowed), bronze enameled aluminum cases, glass fronts, 9" scales, separable sockets; straight or angle pattern so selected that they can be read from the floor. Straight type equal to Weksler Type 105 and angle type equal to Weksler Type 115, Type 125, or Type 135, depending upon the angle and aspect. Furnish thermometers with 2-1/2" stem extensions where they are installed in insulated lines. Select scale ranges for maximum readability at the design temperature of the medium being measured.

E. Thermometers shall be installed in the following locations:

1. At the discharge of each pump or Blending Station valve.
2. At the inlet and outlet of each heat exchanger, evaporator and condenser.
3. At other locations as specified herein or shown on the Drawings.

F. In lieu of the industrial stem type thermometers 5" dial silicon filled bi-metal thermometers with vari-angle feature or “solar only” self-powered digital thermometers (no batteries allowed) with sealed sensor technology, minimum 1/ 2" tall LCD digit size display, 1% accuracy, and variable angle stem assembly shall be allowed.

G. Thermometers and thermometer wells shall be as manufactured by:

1. Weksler.
2. Trerice.
3. Marsh.
4. Taylor.
5. Miljoco.
6. Weiss.

2.11 TEMPERATURE AND PRESSURE TEST PORTS

A. Temperature and Pressure Test Ports, or Pete’s plugs, shall be dual valve type with valve pocket between valves, retaining cap with gasket and cap "saver" connector.

B. These ports may be used at water coil connections in lieu of gauge cocks or needle valves and thermometer test wells.

C. Pete’s plugs shall have the pipe nipple extended to beyond the insulation thickness to make the plug fully accessible and a minimum of one inch (1") above the pipe insulation.

D. Ports shall be as manufactured by:

1. Pete.
2. Autoflow.
3. Flowset.

2.12 RELIEF VALVES

A. All closed water systems shall be protected with a relief valve. Valves shall be spring operated, all brass, and shall meet A.S.M.E. requirements for discharge capacities. Discharge lines shall be piped to the nearest floor drain.

B. Relief valves shall be as manufactured by Watts, Klipfel, McAlear, or McDonnell and Miller.

C. Provide atmospheric relief piping routed to the outdoors as required by local code for all steam and natural gas systems.

2.13 AIR VENTS

A. Provide and install air vents, air eliminators, where shown and at any high points or traps in water circulating lines where air might collect.

B. Each such air vent shall be installed with a valve at its inlet and shall discharge through an integral check valve. The waste lines from the discharge from air vents shall be collected and piped to the nearest floor drain in each case.

C. All automatic air vents shall have cast or ductile iron bodies with corrosion resistant bolts, Buna-N or EPDM seating materials to meet system pressure and temperature requirements, and all stainless steel internal control components.

D. Provide manual air vent cocks, or needle valve, for all water coils where not integral or supplied with coil by manufacturer.

E. Automatic air vents shall be rated for a maximum working pressure of 150 psig and 250 Deg.F.

F. Automatic air vents shall be as manufactured by:

1. Hoffman No. 792.
2. Armstrong No. AAE-750.
3. Bell & Gossett No. 107A.
4. Or equivalent by Amtrol.

2.14 VACUUM RELIEF VALVE

A. All bottom feed domestic water heating equipment shall be protected by a vacuum relief installed on the cold water inlet pipe. Valve shall be compliant with ANSI Z21.22.

B. Acceptable Product: Watts N36-M1 or Apollo VR12.

PART 3 - EXECUTION

3.1 PIPING - GENERAL

A. Where special classes of piping are involved and are not listed, the Contractor shall request instructions from the Owner's Representative as to the class of material involved and the method of fabricating it before ordering any material. All steel lines 2-1/2" and larger shall be assembled by welding. All steel lines 2" and smaller may be assembled either by welding or by screwed fittings as specified.

B. Welding shall be done by mechanics who satisfy qualification requirements of the American Welding Society. The pipe ends to be welded shall be machine beveled wherever possible. Gas cuts shall be true and free from all burned metal. Before welding, surfaces shall be thoroughly cleaned. The piping shall be carefully aligned and no metal shall project within the pipe. Fully ream, to the full inside pipe diameter dimensions, the inside of all piping to be welded. Miter joints will not be allowed in any case. All headers, connections, elbows, reducers, flanges, and special flanges and special fittings shall be made using forged steel welding fittings of the same weight as the pipe to which they are attached. All unions and connections to valves 2-1/2" and larger shall be made by the use of welded flanges.

C. Branches in lines where the branch side is equal to 2/3 of the size of the main or smaller may be connected by using Weldolets or Threadolets; where the sizes are greater than 2/3 of the main, standard weight seamless tees as manufactured by Tube-Turns or Grinnell, A.S.T.M. Standard A-234 shall be used.

D. The location, direction, and size of all lines are generally indicated on the drawings. Branch connections in general are indicated and shall be so installed as to provide proper grades.

E. All lines shall be made up straight and true at proper grades. All water filled and condensate drain lines shall grade down to drains.

F. Piping shall follow as closely as possible the routes shown on the plans and take into consideration conditions to be met at the site. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after proper approval has been obtained.

G. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which the lines are connected.

H. All headers shall be assembled as indicated using welding fittings throughout.

I. All screw joints shall be made with taper threads, properly cut. Joints shall be made tight with graphite and oil applied to the pipe threads only and not to the fittings.

J. Dielectric couplings shall be installed where ferrous pipe joins copper lines and shall be rated for the intended medium pressure and temperature or service.

K. Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of systems. No unions will be required in welded lines or lines assembled with solder joint fittings except at equipment items or coils, machinery items and other special pieces of apparatus. Unions in 2" and smaller lines shall be ground joint and unions 2-1/2" and larger shall be flanged unions. Unions shall be the same material and strength as other fittings in the lines. Companion flanges on lines at various items of equipment, machines, and pieces of apparatus shall serve as unions to permit removal of the particular item.

L. All piping shall be supported by hangers independently of equipment connections. The weight of the piping and it's contents shall not be imposed on the equipment in any way.

M. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

N. Swing joints or expansion loops shall be provided wherever shown on the Drawings or wherever else necessary to allow for the expansion and contraction of piping. This shall be accomplished in an approved manner and this Contractor shall be responsible for any damage which may occur as a result of expansion and contraction of his piping.

O. Nipples shall be of the same size and material as the piping in the system in which the nipples are installed, except that "close", or "all thread" nipples shall not be used.

P. Keep all open ends of piping in each system plugged or capped to prevent dirt or other debris from entering the pipe at any and all times during construction and before fixtures or equipment is connected. All piping shall be flushed clear prior to connection to the central building systems.

Q. The ends of all piping furnished and installed in all systems shall be thoroughly reamed to the full inside diameter of the respective pipe.

R. Exposed and concealed lines shall be run parallel with, and perpendicular to building lines and wherever possible shall be grouped together for easy service and identification. Whenever possible, horizontal and vertical runs shall be held as close as possible to the walls, ceilings, struts, members, etc., so as to occupy the minimum space consistent with the proper installation requirements for insulation, conduit, ductwork, lighting fixtures, etc., and the expansion requirements of each of these items and the building proper or the removal of the respective or adjacent pipes, conduits, and ductwork, and to allow for necessary access to valves, other pipes, conduits, dampers, etc.

S. Valves required for control or isolation of any part of the various systems shall be provided and shall be located in approved or accessible positions or made accessible through removable panels, etc., and where several valves are related as to function, they shall be grouped in a battery. Request approval from Owner's Representative for proper location of all access panels required for valves, etc.

T. All automatic control valves shall be installed such that the valve stem is pointed upwards, vertical, and in no case shall it be mounted at less than a 45 degree angle from the vertical position unless specifically approved by the Engineer prior to installation.

U. All shut-off and isolation valves shall generally be installed with valve stems pointed vertically upwards. In no case shall valve stems be pointed downwards or less than in a horizontal position.

V. Where new lines are indicated to connect into existing lines, careful coordination shall be exercised to determine exact elevations and locations of existing lines, to establish grades of interconnecting new lines, to establish procedures to interconnect lines, and to establish other details.

3.2 CROSS CONNECTION AND INTERCONNECTIONS

A. No plumbing fixtures, device, or piping shall be installed which will provide a cross connection or interconnection between a distributing water supply for drinking or domestic purposes and a polluted

supply such as drainage system, or a soil or waste pipe which will permit or make possible the backflow of sewage, polluted water, or waste into the water supply system.

3.3 EXCAVATION AND BACKFILLING

A. Provide necessary excavating and backfilling for the installation of work specified in this Division as specified in Section 22 05 00 and 31 23 00. Shall comply with ASTM 2321.

3.4 FLASHINGS

A. Flash around all pipes passing through the roof with sheet lead, as specified in Section 07525, built a minimum of 10" into the roofing, in all directions from the outside of the pipe running up the pipe a minimum of 10" and more where vent terminals must be higher to conform to the requirements of the local Plumbing Code in effect, and then turned over one inch (1") into the pipe cavity. All seams and joints shall be completely soldered closed and the entire flashing shall be completely waterproof.

B. Make all roof penetrations in accordance with the roofing system manufacturers approved methods and as specified in Section 07 52 50.

3.5 PIPE INSULATION INSERTS AND SHIELDS

A. Provide a section of Foamglas insulation, calcium silicate, or urethane of thickness specified at hanger support locations and provide No. 16 gauge galvanized steel protection shield minimum 12" long. Shield shall be full half cylinders equal to Grinnell Fig. 167.

B. Refer to Section 22 07 00, Insulation.

3.6 SAFETY GUARDS

A. Furnish and install all safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction.

B. All belt driven equipment, projecting shafts and other rotating parts shall be enclosed or adequately guarded.

3.7 TESTING AND REPAIRING

A. During the progress of each portion of the work or upon its completion, make such tests of this work as herein specified, or as required by the Architect, or by State or Municipal Bureaus having jurisdiction and under their supervision.

B. Provide all apparatus, temporary piping connections, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building and its contents incurred by such tests as will be required to repair and make good, at no cost to the Owner, any damage so caused. Testing of piping to be insulated shall be done before insulation is applied.

C. Perform any other tests as may be required by the Owner's Representative to indicate the fulfillment of specification requirements.

D. Pressure piping systems shall be tested with either water or air to a pressure of 150 psig or to 1-1/2 times the operating pressure, whichever is the greatest, for six (6) hours.

E. Domestic hot and cold water piping shall be tested at 1.5 times the operating pressure or 150 PSIG, whichever is greater, for six (6) hours. Any leaks developed shall be made tight and the test repeated. Test pressure shall not be applied to specialties, but joint shall be tested for leaks at operating pressure when complete.

F. Waste and vent piping shall be tested at completion of the rough work and before fixtures and traps are connected. Openings, except tops of bends, are to be plugged and the system completely filled with water. System shall stand without leak or loss of water for a period of not less than four (4) hours.

G. Systems shall be tested in portions as required by the construction schedule and the portions being tested shall be effectively isolated and sealed off. When previously tested sections are connected into other sections, tests shall be rerun to include the new connections.

H. Partial systems shall be tested prior to connecting into existing lines.

I. Leaks in screwed joints shall be repaired by tightening the joint until the leak has stopped, or by remaking the joint if tightening fails to stop the leak. Leaks in welded joints shall be repaired by chipping out the weld around the leak and rewelding until it is stopped. Leaks in caulked joints shall be completely stopped by additional caulking of the joint, but, if that fails, the joint shall be re-made. A leak in a compression joint shall be repaired by remaking the joint using a new seal, compression ring, coupling, etc., as required. Leaks in soldered joints shall be repaired by remaking the joint and no soldering or brazing over existing joints will be permitted. Any defective piping shall be replaced.

J. Additional testing shall be as specified in the individual Sections of these Specifications.

K. During testing and cleaning of piping systems, use a fine mesh, 20 mesh or smaller, start-up strainer screen for all strainer pipe sizes. After piping system is cleaned each strainer shall be taken apart, cleaned, and final strainer mesh shall be placed back in strainer for normal operating conditions.

3.8 SEALING PENETRATIONS

A. Seal all pipe penetrations through walls run to structure, ceilings, floors and roofs. Fill the annular space between the insulation on the pipe, or the pipe only where uninsulated, and its sleeve, with neoprene or non-hardening sealant.

B. No pipe or duct shall be allowed to contact its surrounding sleeve or the wall, floor, or ceiling. Effective isolation shall be provided as described in Section 23 05 48 to the end that no vibration or direct noise transmission shall be transmitted. Vibration transmission limits shall be as established in Section 23 05 48. Use special materials as may be required to comply.

C. Firestop pipe and duct floor and wall penetrations as specified in Section 07 84 00 and 22 05 00.

3.9 PAINTING

A. All equipment specified in Division 22 shall be delivered to the site with suitable factory finishes as specified elsewhere herein.

B. Items with factory applied finishes shall be protected during installation and other construction work. Damaged factory applied finishes shall be refinished to match the original finish appearance.

C. Field painting of items specified and installed in Division 22 shall be as specified in Section 09 90 00.

D. All ferrous metals that are not galvanized or made of a corrosion resistant alloy shall be painted. This shall include steel pipe hangars, trapeze supports, pipe stands, all thread hangar rods and other miscellaneous systems.

END OF SECTION

SECTION 22 30 00

DOMESTIC WATER HEATING EQUIPMENT AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 01 - General Requirements and referenced documents.

B. Comply with Division 22 Sections, as applicable. Refer to other Divisions for coordination of work with other sections of the specifications, as required.

1.2 SYSTEM DESCRIPTION

A. Provide a complete and operational system of Domestic Water Heating Equipment and Accessories as indicated herein and as indicated on the Drawings.

B. Completely coordinate specified herein work of all other sections of these specifications.

C. Furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a complete and satisfactory operating installation, whether such work is specifically indicated or not.

1.3 QUALITY ASSURANCE

A. Factory Testing: Subject each tank to a factory hydrostatic test pressure of 150 percent of the expected maximum system working pressure and certify that components are free of leaks prior to shipment to the project site. Tank shall have a minimum pressure rating of 150 psig.

B. Manufacturing Standard: Tank shall comply with the ASME Pressure Vessel Code, Section IV.

C. Each water heater (and/or heat exchanger and storage tank) shall have a written unconditional one (1) year cost free service policy, and a written full three (3) year parts and labor warranty against tank failure due to rust, corrosion, or electrolytic action.

D. Each heater shall be UL Listed and Labeled.

E. Each water heater tank shall have fiberglass insulation to meet ASHRAE Standard 90-1b for heat loss and protected by epoxy coated metal jacket.

1.4 SUBMITTALS

A. Project Data:

1. Operating and Maintenance Data, three (3) copies.
2. Furnish factory obtained State Inspection Report and Stamp.
3. Manufacturer's approved Startup Report completed by factory trained and authorized technicians to be furnished to Engineer.
4. Written Equipment Warranties, complete and filled out.

B. Product Data:

1. Electric Storage Water Heaters.
2. Condensing Gas Fired Tank Water Heaters.
3. Thermal Expansion Tanks.
4. Circulating Pumps, Aquastat and programmable timer.
5. Thermostatic Mixing Valves.

PART 2 - PRODUCTS

2.1 ELECTRIC STORAGE TYPE WATER HEATERS (6 GALLONS THROUGH 90 GALLONS)

A. Provide in each location shown on the Drawings, a glass-lined electric storage type water heater of the size and capacity indicated. Heating elements shall be suitable for electrical current having the characteristics indicated on the drawings. Each heater shall be U.L. Listed and Labeled.

B. Provide factory installed with dial thermostat, high temperature cut-off switch and high temperature and pressure relief valve. Valve shall be of the size and type to meet ASME standards for discharge capacity. Pipe relief valve full size to an approve drain.

C. Tank shall be glass lined internally with alkaline borosilicate composite fused to steel by heating to 1600 Deg.F. Tank shall be furnished with a magnesium anode for corrosion protection.

D. All tanks shall be insulated to meet ASHRAE 90.1b for standby heat loss.

E. Each tank shall be equipped with necessary operating controls.

F. Acceptable manufactures:

1. State
2. A.O. Smith
3. Rheem/Rudd

2.2 CONDERNSING POWERED GAS FIRED COMMERCIAL WATER HEATERS, STORAGE TYPE

A. Furnish and install a condensing, automatic storage type water heater with a submerged combustion fire tube as indicated and located on the drawings and of capacities, characteristics, sizes, etc., as scheduled on the drawings. Heater shall meet or exceed the current ASHRAE 90 Minimum Performance of Water Heating Equipment, effective January 1, 1994.

B. Water heater shall comply with the Low Nox regulations of TECQ (formerly TNRCC).

C. Water heater shall be a category IV, condensing appliance. It will be UL listed for use with pressurized, with material as approved by the water heater manufacturer up to inline draft inducers as required. Refer to Div. 23 for additional requirements.

D. The heater shall utilize a completely submerged fire tube heat exchanger. For corrosion protection, all wetted surfaces will be of non-ferrous materials or alloys.

E. Combustion shall be provided by a forced-draft power burner. The burner shall have a leak-free, fan housing for quiet operation, and shall be U.L. Listed. The gas burner shall meet the specifications required by U.L. Provide inline draft inducer where the horizontal flue pipe exceeds 25% of the total flue distance. Furnish draft inducers where required to assure proper operation of the heating equipment.

F. Gas water heaters shall be A.G.A. or U.L. approved for natural gas and approved to operate at 140 Deg.F., and rated for 150 PSI working pressure.

G. Tank Liners:

1. Tank shall be a stainless steel alloy furnished with a magnesium anode for corrosion protection.
2. Or, tank shall be glass lined internally with alkaline borosilicate composite fused to steel by heating to 1600 Deg.F. and furnished with a magnesium anode for corrosion protection

H. The water heaters shall be manufactured by a company that has achieved certification to the ISO 9001 International Quality System, which requires regular external auditing of all order entry, engineering design, and product manufacturing processes. The heater shall satisfy current Federal Energy Policy Act (EPACT) standards for both thermal efficiency and standby heat losses as established for gas-fired water heaters incorporating storage tanks.

I. Heater shall have adjustable thermostat, high-limit thermostat, pressure regulator, spark ignition with interrupted pilot and factory set to burn natural gas. The heater shall be U.L. or AGA labeled, constructed with Section IV of the ASME Code. Tank shall be National Board Registered and stamped for 150 PSI operating pressure. Provide A.G.A. rated pressure and temperature relief valves. The P&T valves shall be set for 205 Deg.F. and 150 pounds pressure and shall be of the self-closing type. Install the relief valves so that the bulbs will be immersed in the tanks. Pipe relief valve outlets full size to the nearest floor drain, or outside per requirements of local authorities.

J. Contractor shall provide a gas train pressure regulator as required in order to meet the minimum gas pressure needed for all the heaters to fire at the same time.

K. Heater shall be supply from the manufacturer with a minimum 15 year warranty.

L. Acceptable manufactures:

1. PVI
2. A. O. Smith

2.3 THERMAL EXPANSION TANKS

A. Furnish and install a steel pressure vessel furnished with either a stainless steel or galvanized steel head. The pressure vessel shall be designed and constructed per ASME Section VIII, Division 1, with a maximum allowable working pressure equal to or greater than the water heater but no less than 125 psig. Tank shall be equipped with FDA approved heavy duty butyl rubber bladder or diaphragm removable for inspection to provide permanent separation between the air and expanded fluid. The air in the tank shall be contained on the shell side with all expanded fluids being directed in to the bladder or diaphragm chamber. Entire unit shall be FDA approved for potable water systems.

B. Expansion tanks serving water heaters with storage greater than 119 gallons and or with heat input of more than 200,000 BTU shall be ASME rated as required by the State Boiler Code.

C. Thermal expansion tank sizing shall be as scheduled on the drawings and be per the manufacturer's recommendation:

D. Provide thermal expansion tanks for each domestic water system where a check valve, or other backflow prevention devices, are installed on the cold water supply to the water heating equipment. Tanks shall be NSF or FDA approved.

E. Acceptable manufacturers:

1. Bell and Gossett "PT" series.
2. Watts "DET" Series.
3. Amtrol “Therm-X-Trol”, or approved equals only

2.4 HOT WATER CIRCULATING PUMPS

A. Provide centrifugal type in-line circulating pumps with associated controls to circulate the hot water in domestic hot water systems where indicated on the Drawings.

B. Each pump shall be Inline Boosters with bronze impeller and bronze body, designed for installation in open systems.

C. Furnish an Allen Bradley Bulletin 600 manual starter with thermal overload protection for the control of each pump motor and aquastat with adjustable set point for thermostatic control of pump.

D. Furnish with each pump two ball type isolation valves, discharge check valve, thermometer and aquastat. Provide gauge taps and cocks at inlet and outlet of each pump for testing.

E. Recirculating pumps are required to be controlled by the Building Management System.

F. Capacities of each pump shall be as scheduled on the Drawings

G. The Aquastat shall be set at a temperature differential of -5 Deg. F. The return loop temperature shall be set to 5 degrees below the supply loop temperature.

H. Acceptable Manufacturers:

1. Grundfos
2. Bell and Gossett
3. TACO.
4. Armstrong.

2.5 THERMOSTAT MIXING VALVE

A. TM-1: Leonard Model LF-270, thermostatic point of use mixing valve shall be allowed for single fixture use only and shall be ASSE 1070 listed. Valve shall be bronze body, stainless steel dire and spring, adjustable with locking feature. Copper thermostat assembly. Provide straight check stops, IPS connection. Equal by RADA-215D or Powers LFLM-495.

2.6 FLUE PIPING

A. Refer to the manufacturer and Div. 23 for flue piping requirement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water heaters in accordance with manufacturer's recommendations. Install the relief valves so that the bulbs will be immersed in the tanks. Pipe relief valve outlet full size to the nearest floor drain, hub drain, or outside as required by Governing Authorities and Codes.

B. Install a union, dirt leg, and gas shut-off cock at each water heater.

C. Adjust gas pressure regulator at heaters for proper firing capabilities.

D. Install flues as supplied and recommended by the water heater manufacturer.

E. Coordinate with other trades to provide equipment housekeeping pads as shown on the drawings and per Section 22 05 00.

F. Coordinate with Structural Engineer for approved wall mounted or suspended platforms to support electric water heaters located above the floor. Submit equipment weights and proposed supports, brackets and platform framing to the Structural Engineer for review and approval prior to purchasing or fabricating platform.

G. Furnish Operations and Maintenance Manuals, and written warranty, for each domestic water heating equipment and accessories as required in Division 01 specifications and Section 22 0500.

H. Provide thermal expansion protection for all heating equipment as specified and required by heating equipment manufacturer's written warranty.

I. All thermostatic mixing valves or other “anti-scalding” devices shall be concealed in walls and fully accessible for service, repair, or replacement through an adequately sized access door panel with a loose key lock.

J. Domestic water heaters in excess of 119 gallons storage and/or heat input in excess of 200,000 BTU/Hr shall be installed to meet all location and clearance requirements as set forth in the Texas State Boiler Law, which includes, but is not limited to; a minimum horizontal clearance of two feet on all sides of the heater and a minimum vertical clearance of four feet from the top of the heater to the bottom of the roof joist or above floor structure.

K. Coordinate with the Electrical Contractor for available voltage, phase and circuit breaker size required for the heater. Electrical requirements shall be verified prior to ordering equipment.

L. Furnish and install heat traps on the supply and discharge piping for all domestic heating water systems not provided with recirculation system and/or water heating equipment with integral heat traps.

M. Furnish and install relief valves on cold water inlet piping for all bottom feed water heaters. Valve shall comply with ANSI Z21.22.

N. Refer to Division 23 00 00 for sheet metal and flue piping requirements. In line draft induces shall be provided as part of the flue piping system. Size and capacity of in line induces shall be based on actual equipment installed and field conditions.

END OF SECTION

SECTION 22 42 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 01 - General Requirements and referenced documents.

B. Comply with Division 22 Sections, as applicable. Refer to other Divisions for coordination of work with other portions of the work.

1.2 SYSTEM DESCRIPTION

A. Provide items of plumbing related equipment and accessories as indicated herein and as illustrated on the Drawings.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 70 00.

B. Indicate on submittal construction materials, finishes, sizes, quantities and related hardware.

C. Product Data:

1. Plumbing fixtures.
2. Carriers.
3. Fixture trim.

D. Certification: Submit certification that completed system complies with test requirements of municipality, State, and other public authorities having jurisdiction over system.

E. Provide closeout documents as required in Division 1, Section 01 70 00.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in following order of precedence:

1. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing, including local codes.
2. Provisions specified in this Section.
3. International Plumbing Code.

1.5 HANDLING

A. Deliver fixtures crated and in undamaged condition.

B. Replace damaged fixtures with new fixtures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

NOTE: The following manufacturers are considered acceptable, however, products submitted in lieu of specified item shall be equivalent to specified item as determined by the Architect and Engineer.

A. Standard Plumbing Fixtures:

1. American Standard.
2. Kohler.
3. Sloan.
4. Zurn
5. Elkay.
6. Just.
7. Bradley.
8. Acorn.

B. Carriers (Minimum 1,000 lb.carriers):

1. Jay R. Smith.
2. Zurn.
3. Wade.
4. Josam.
5. Watts.

C. Seats:

1. Church.
2. Beneke.
3. Olsonite.
4. Centoco.

D. Faucets:

1. Chicago.
2. T&S Brass.
3. Zurn Aqua Spec.

E. Flush Valves (Dual Flush with Signage for Waterclosets):

1. Sloan, Uppercut, or Zurn, Aqua Vantage AV.

F. Lead-Free Stop Valve in Hot and Cold Supply Lines to Each Fixture:

1. Chicago.
2. McGuire.
3. T&S Brass.
4. Engineered Brass Company.

G. Stainless Steel Sinks:

1. Elkay.
2. Just.

H. Service Sinks:

1. Fiat
2. Stern Williams.
3. American Standard.
4. Acorn.

I. Electric Water Coolers:

1. Halsey-Taylor.
2. Elkay.
3. Haws.

J. Showers:

1. Acorn.

2. Bradley.
3. Symmons.
4. Leonard.
5. Powers.

K. Wash Fountain:

1. Bradley.
2. Sloan.

2.2 MATERIALS

A. Fittings: Chrome plated heavy cast brass.

B. Nipples: Extra heavy. Provide brass nipples or stainless steel nipples for domestic water systems including nipples at water heater & storage tank connection (no black steel nipples shall be allowed in domestic water systems).

C. Plumbing Fixture Trim: Solid brass, including nuts and washers, handles, hold-down screws, valve bodies, swivel spouts, ferrules, sleeves, locknuts, and bushings.

D. Piping Connections from Shutoff or Stop Valve to Fixture: Chrome plated brass pipe or chrome plated copper tubing.

E. Floor and Wall Escutcheons: Chromium plated with set screws.

F. Exposed Fixture Trimmings and Fittings: Chromium plated brass with polished, bright surfaces.

G. Flush Valves: Non-hold open type, without seat bumpers.

H. Traps: Chrome cast brass adjustable P-traps with cleanout.

2.3 DESIGN AND FABRICATION

A. Plumbing fixture trims shall allow renewable operating units to be removed without detaching supply fitting or faucet.

B. Fixtures, except water closets and urinals, shall have water supply above rim.

C. Equip fixtures with supply discharge below rims with backflow preventers.

D. Furnish angle stops, straight lock shield, loose-key pattern stops for supplies’ and install with fixtures. Supplies shall be rigid, unless noted otherwise.

E. Exposed traps and supply pipes for fixtures shall be connected to rough piping systems at wall.

F. All plumbing trim and fixtures indicated on Drawings as handicap shall meet the current requirements of the Americans with Disabilities Act (ADA) and the Texas Accessibility Standards (TAS).

G. Faucets, bubblers, & supply stops shall be National Sanitation Foundation (NSF) Standard 61, Section 9, compliant and listed for residential/drinking water use as required by the Federal Clean Water act effective January 1, 1997 in addition shall be Lead-Free per “Safe Drinking Water Act” U.S. Senate Bill S.3874.

2.4 PLUMBING FIXTURE SCHEDULE

A. WATER CLOSETS:

WC-1 - WATER CLOSET - WALL HUNG-FLUSH VALVE - STUDENT:

1. Sloan ST-2459, wall hung siphon jet, elongated bowl, vitreous china with 1-1/2" top spud.

2. Flush valve: Sloan "Uppercut" WES-111, Dual flush 1.6/1.1 GPF, polished chrome, externally adjustable, diaphragm type with 1" screwdriver angle stop, metal oscillating handle with sweat solder adaptor kit and cast wall flange with set screw. Contractor shall provide manufacturer provided signage.
3. Seat: Church 9400-SSC (5321.112) solid plastic, white, elongated, open front seat, less cover, combination check and self-sustaining hinges with stainless steel posts.
4. Support: Jay R Smith 0211-M54-XK Series (Min. 1,000 lbs) closet carrier and fitting. Provide back-to-back and single installations as job requires.
5. Mounting height as directed by Architect.

WC-2 - WATER CLOSET - WALL HUNG-FLUSH VALVE – STUDENT HANDICAP:

1. Same as specified for WC-1 water closet, except mount in compliance with ADA/TAS for handicapped use of primary user (student).
2. Mounting height as directed by Architect.

WC-3 - WATER CLOSET - WALL HUNG-FLUSH VALVE – ADULT HANDICAP:

1. Same as specified for WC-1 water closet, except mount in compliance with ADA/TAS for handicapped use of primary user (adult).
2. Mounting height as directed by Architect.

U-1 - URINAL:

1. Sloan SU-1009, wall hung, siphon jet with raised dome strainer, vitreous china with 3/4" top spud, flushing rim and 2" female outlet connection.
2. Flush valve: Sloan "Royal" 186-0.5-YBYC, 0.5 GPF, polished chrome, externally adjustable, diaphragm type, with 3/4" screwdriver angle stop, metal oscillating handle with sweat solder adapter kit and cast wall flange with set screw.
3. Support: Jay R Smith 0636 Series floor mounted carrier with bearing plate.
4. Mounting height as directed by Architect.

U-2 - URINAL - HANDICAP:

1. Sloan SU-1009, wall hung, siphon jet with raised dome strainer, vitreous china with 3/4" top spud, 14-1/2" elongated, flushing rim and 2" female outlet connection.
2. Flush valve: Sloan "Royal" 186-0.5-YBYC, 0.5 GPF, polished chrome, externally adjustable, diaphragm type, with 3/4" screwdriver angle stop, metal oscillating handle with sweat solder adaptor kit and cast wall flange with set screw.
3. Support: Jay R Smith 0636 Series floor mounted carrier with bearing plate.
4. Mounting height as directed by Architect.

L-1 - LAVATORY - WALL HUNG:

1. Same as fixture Type 'L-2' - except provide straight tailpiece in lieu of wheelchair off-set tailpiece and less insulation kit.
2. Mounting height as directed by Architect.

L-2 LAVATORY - WALL HUNG – TEMPERED WATER ONLY - HANDICAP:

1. Sloan SS-3065, 20" x 18" vitreous china, "D" shaped bowl, self-draining deck with side and back splash, modified to comply with ADA front approach requirements, 4" faucet centers, punched for concealed arms.
2. T&S Brass B-0805-VR-VF05, cast brass valve body, 7" integral spout, 4" centers with 4” locking plate, mechanical metered vandal-resistant, ADA Compliant, vandalproof aerator with integral 0.5 GPM flow restrictor. Provide Chicago 327-XCP perforated grid drain and wheelchair offset tailpiece for ADA front approach access.
3. Supplies: McGuire braided stainless steel riser supplies with loose key angle stops and chrome escutcheon plate with set screw.
4. Trap: McGuire 1-1/4" x 1-1/2", 17 gauge, chrome cast brass P-trap with cleanout plug and chrome escutcheon plate with set screw.

5. Support: Josam 17100 Series floor mounted carrier with concealed arms.
6. Insulate exposed water supplies and drain piping with ADA approved insulation kit, equal to Truebro "Lav-Guard" Kit No. 102 and 105.
7. Mounting height as directed by Architect.

L-3 LAVATORY - WALL HUNG - HOT AND COLD WATER - HANDICAP:

1. Sloan SS-3865, 22" x 20” vitreous china, "D" shaped bowl, self-draining deck with side and back splash, modified to comply with ADA front approach requirements, 8" faucet centers, punched for concealed arms.
2. Faucet/Strainer: T & S Brass B-2990-WH4-QT, cast brass valve body, 8" centers, metal lever vandal-resistant color coded chrome handles, quarter turn operating ceramic cartridge, ADA Compliant, vandalproof aerator with integral 0.5 GPM flow restrictor.
3. Provide Chicago 327-XCP perforated grid drain and wheelchair offset tailpiece for ADA front approach access.
4. Supplies: McGuire chrome riser supplies with loose key angle stops and chrome escutcheon plate with set screw.
5. Trap: McGuire 1-1/4" x 1-1/2", 17 gauge, chrome cast brass P-trap with cleanout plug and chrome escutcheon plate with set screw.
6. Support: Josam 17100 Series floor mounted carrier with concealed arms.
7. Insulate exposed water supplies and drain piping with ADA approved insulation kit, equal to Truebro "Lav-Guard" Kit No. 102 and 105.
8. Mounting height as directed by Architect.

EWC-1 - ELECTRIC WATER COOLER - HI/LO - WALL HUNG - ADA COMPLIANT WITH BOTTLE FILLER

1. Halsey-Taylor HTHB-HVRGRN-8BLSS-WF, barrier-free, ADA Compliant Bi-Level wall hung electric water cooler with hermetically sealed air cooled condensing unit, self-closing anti-squirt flexi-guard bubbler volume regulator with front and side push-bars and with bottle filler and filter. Cooler shall deliver 8.0 GPH of 50 Deg.F. water at 90 Deg.F. ambient and 80 Deg.F. inlet water. **Entire unit shall be all satin stainless steel finish**, upper basin, middle shroud, side panels and lower shroud. Furnish accessory apron when units are mounted on an exposed wall or necessary to provide the ADA mandatory underside clearance. Provide Owner with 12 pack filter replacement, 55898C-12PK.
2. Support: Josam 17900 Series floor mounted carrier.
3. Supplies: McGuire chrome riser supply with wheel handle stop and chrome escutcheon plate with set screw.
4. Trap: McGuire 1-1/4" x 1-1/2", 17 gauge, chrome cast brass P-trap with cleanout plug and chrome escutcheon plate with set screw.
5. Mounting height as directed by Architect.

WF-1 - THREE (3) STATION WASH FOUNTAIN - ADA/TAS COMPLIANT

1. Sloan three station Model EWF-43000 wall mounted station solid surface with pre-assembled water distribution head, wall mounting automatic infrared metering, vandal resistant distribution head is constructed of heavy gauge type 304 stainless steel, polished to a satin finish. Furnished with metering buttons and spray nozzles, thermostatic mixing valve, check stops and strainers, drain spud, flexible supply hoses, control valves, color coded water lines, Class II, 120/24 VAC plug-in transformer and thermostatic mixing valve.
2. Provide with automatic infrared sensor metering with non-hold-open valve including a check stop and strainer.
3. Color selected by the Architect.
4. Furnish with McGuire chrome supplies and wheel handle angle stops and chrome set screw escutcheon through wall.
5. Shall meet ADA/TAS accessibility requirements.

S-1 - GENERAL PURPOSE SINK (FRONT APPROACH):

1. Elkay LRAD-1918, single compartment, Type 302, 18 gauge stainless steel, 16" x 11-1/2" x 6-1/2" deep, self-rimming, sound deadened underside, faucet deck, 3 hole punch, 3-1/2" drain opening, off-set front-to-back ADA Compliant.

2. Faucet: B-2866-01-VRS-QT, bottom mount, cast brass valve body, rigid copper, 8" centers, gooseneck rigid spout, quarter-turn 4" wrist blade lever vandal-resistant color coded chrome handles, ADA compliant, with vandalproof aerator.
3. Supplies: McGuire chrome riser supplies with wheel handle angle stops with chrome escutcheon plate with set screw.
4. Tailpiece and Strainer: McGuire #151A stainless steel strainer drain with conical strainer basket and neoprene stopper, 1-1/2" o.d. off-set wheelchair chrome plated brass tailpiece.
5. Trap: McGuire 1-1/2" x 1-1/2", 17 gauge, chrome cast brass P-trap with cleanout plug, and chrome escutcheon plate with set screw.
6. Insulate exposed water supplies and drain piping with ADA approved insulation kit, equal to Truebro "Lav-Guard" Kit No. 102 and 105.
7. Mounting height as directed by Architect.

S-2 – CONCESSIONS (FREE STANDING):

1. Elkay Model SS-8354 "Sturdibilt" 57" x 27-1/2" with 8" backsplash, triple compartment 57" x 24" x 14" deep, #14 gauge nickel bearing stainless steel. Type 304, square corner welded construction. Welds cleanably smooth. Sink polished to an Lk-5K satin finish. Channel rims, straight line styling. Sink compartment pitched to drain. Sink supported on (4) LK-251 stainless steel tubular legs, 1-5/8" O.D., with adjustable bullet shaped feet. Unit drilled for standard faucet and drain outlets.
2. Faucet: T&S Brass B-0133-12-CRB8P, cast brass, 8” back mount faucet, lever handles, integral checks, ceramic quarter turn faucet handle, 2.2 gpm vandal resistant aerator, pull-down activated sprayer & 12” secondary spout.
3. Faucet: T&S Brass B-0231, cast brass, 8” back mount faucet, lever handles, integral checks, ceramic quarter turn faucet handle, 2.2 gpm vandal resistant aerator & 12” spout.
4. Strainer: Elkay No. LK-24-RT waste fitting with lever handle.
5. Supplies: McGuire chrome riser supplies with loose key angle stops and chrome escutcheon plate with set screw.
6. Trap: McGuire 1-1/2" x 1-1/2", 17 gauge, chrome cast brass P-trap with cleanout plug, and chrome escutcheon plate with set screw.

MS-1 - MOP SINK:

1. Stern Williams “Corlow” SBC-1700 terrazzo 24 inch by 24 inch floor mounted basin with 12 inch high walls with 302 stainless steel cap cast integral on threshold. Drain shall be cast brass drain body with stainless steel strainer, flat head, and slotted machine screws included.
2. Faucet: T&S Brass B-0665-CR-BSTP chrome plated, integral check stops, vacuum breaker, wall bracket pail hook, 3/4 inch hose thread, 8 inch center, and arm handle.
3. 5'-0" Hose with Hose Bracket: Stern-Williams T35.
4. Splash Catcher Panel of 20 Gauge, 304 Stainless Steel: Stern Williams BP.
5. Important: Float basin with wet mortar between slab and basin to distribute weight evenly and prevent cracking of basin. Refer to installation recommendations by manufacturer.

SH-1 - GANG SHOWER (3 STATIONS)

1. Shower Assembly: Bradley "Econo-Wall No. WS-3W-HD-SF-LBJ-ST-RSD-SHV-MS-HR; 3 station wall mounted pressure balancing shower. Housing to be 18 gauge, 304 stainless steel with deluxe showerhead lockable ball joint, recessed soap dish, supply stops, stainless steel shroud assembly to conceal overhead pipes and Multi-Stall Partition with Herculite Curtain.
2. Shower Valve: Bradley EF-HD-IS pressure balancing shower valve with internal stops, stainless steel handle and color coded plate. Provide factory stops and checks at each supply. Contractor shall adjust temperature setting to deliver a max, of 110 Deg. F.
3. Shower Head: Bradley (SF) shower head with lockable spray adjustment chrome plated brass body, self-cleaning shower spray disc, movable components secured by vandalproof set screws, and lockable Universal ball joint. Mount head 6"-0" A.F.F. for men.
4. Flow Control: Bradley (2.0FC) 2.0 gpm flow restrictor.

SH-2 - SHOWER – STUDENT - HANDICAP:

1. Shower: Leonard PAM -II-ST "Pressure Activated Mixer", 1/2" inlets, 1/2" outlet, concealed piping, bronze and stainless steel construction, control valve shall be adjustable high temperature limit stop,

with built-in shut-off, color coded dial indicator, wall flange, exposed parts stainless steel or chrome plated, with angle check stops and copper tube connection, DL2 inline diverter with lever handle..

2. Hand Held Shower Head: Leonard 62001-2.0 fixed spray hand shower with non-positive shut-off, 24" chrome plated wall bar with adjustable mounting flange and adjustable height slide bracket, chrome plated brass swivel connector, 69" chrome hose with quick disconnect, chrome plated supply elbow with flange and inline vacuum breaker, flow rate 2.0 GPM. Fixed shower head, Sloan AC-450-2.0, self-cleaning universal ball joint, volume control. lever operated, brass construction, chrome plated arm and flange, 2.0 GPM flow rate.
3. Diverter Valve: Leonard D2L.
4. Factory installed check valves on both the hot and cold water supplies. The mixing valve shall be factory pre-set for 120 Deg.F. maximum temperature. Contractor shall adjust temperature setting to deliver a max. of 110 Deg. F.
5. Shower Basin and/or enclosure shall be specified in other Division of Architectural Specifications. Drain shall be stainless steel cast integral with basin, or equal to Floor Drain FD-1, as specified in Section 22 13 16.
6. All shower controls and heads shall be located per Architectural Drawings, and shall comply with ADA mounting height requirements. All piping in wall and shower head shall be rigidly secured.

SH-3 - SHOWER – ADULT - HANDICAP:

1. Shower: Leonard PAM -II-ST "Pressure Activated Mixer", 1/2" inlets, 1/2" outlet, concealed piping, bronze and stainless steel construction, control valve shall be adjustable high temperature limit stop, with built-in shut-off, color coded dial indicator, wall flange, exposed parts stainless steel or chrome plated, with angle check stops and copper tube connection, DL2 inline diverter with lever handle..
2. Hand Held Shower Head: Leonard 62001 fixed spray hand shower with non-positive shut-off, 24" chrome plated wall bar with adjustable mounting flange and adjustable height slide bracket, chrome plated brass swivel connector, 69" chrome hose with quick disconnect, chrome plated supply elbow with flange and inline vacuum breaker, flow rate 2.0 GPM. Fixed shower head, Sloan AC-11, self-cleaning universal ball joint, volume control, lever operated, brass construction, chrome plated arm and flange, 2.0 GPM flow rate.
3. Diverter Valve: Leonard D2L.
4. Factory installed check valves on both the hot and cold water supplies. The mixing valve shall be factory pre-set for 120 Deg.F. maximum temperature. Contractor shall adjust temperature setting to deliver a max. of 110 Deg. F.
5. Shower Basin and/or enclosure shall be specified in other Division of Architectural Specifications. Drain shall be stainless steel cast integral with basin, or equal to Floor Drain FD-1, as specified in Section 22 13 16.
6. All shower controls and heads shall be located per Architectural Drawings, and shall comply with ADA mounting height requirements. All piping in wall and shower head shall be rigidly secured.

WCB-1 - RESIDENTIAL WASHING MACHINE CONNECTION BOX:

1. Guy Gray Model MWB-19 Series, 20 gauge steel box hot dipped galvanized, two inch (2") drain and 1/2" hose bibbs, with individual quarter turn ball valve and hammer arrestor.

ICB-1 - ICEMAKER BOX CONNECTION

1. Guy Gray Model SSMIB-6AB, 20 gauge stainless steel box, and ½" quarter turn angle valve with hammer arrestor.

ACC-1 - AIR CONDITIONING CONDENSATE

1. Guy Gray Model T-200-LY stainless steel box, 2" drain, less hose valves a supply connectors.
2. Provide stainless steel access door and mounting frame with cylinder lock and key, sized to cover box.
3. Provide cut-off and trap primer inside box. Precision plumbing products, Model "CPO-500".
4. Mounting Height to be 6" AFF. Coordinate location with Architect and Finish Conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's printed instructions and drawings.

B. Fasten fixtures secured to masonry walls or stud partitions with 1/4" brass toggle or through-bolts.

C. Anchor inserts flush with finished wall and conceal when fixtures are mounted.

D. Fixture Connections:

1. Make connections between earthenware fixtures and flanges on soil pipe gas tight and watertight with closet-setting compound or with neoprene gasket and seal.
2. Do not use natural rubber gaskets or putty for these connections.
3. Bolts shall be not less than 1/4" diameter and shall be equipped with chromium plated nuts and washers.
4. Set fixtures with outlet flanges required distance from floor or wall to make first class joint with gasket and fixture used.

E. Refer to Architectural Drawings for all mounting heights and exact locations. Coordinate with General Contractor prior to starting any work, provide any additional supports, hangers, openings, etc. as required for a complete installation. Coordinate all clearances and locations with other trades as required.

F. Provide stop valve in each hot and cold water supply line to each fixture.

3.2 KITCHEN EQUIPMENT; MILLWORK AND CASEWORK FIXTURES

A. Furnish and install all sinks and other plumbing items shown on furniture, unless shown otherwise. Provide detailed information to the supplier of such furniture as to required cut-outs and drillings, so as to permit proper coordination during fabrication. Provide local shut-off valves in all supplied to such furniture. Provide all waste connections, including drains, p-traps and other materials, using sanitary materials corresponding to piping system material in each case.

3.3 FIXTURES FURNISHED UNDER THIS DIVISION

A. Plumbing fixtures and equipment shall be set in place, leveled and connected as indicated on the drawings. Use china caps to conceal mounting bolts, and grout between all vitreous china fixtures and finished wall and floor surfaces with plaster of paris or portland cement.

B. Install wall hung water closets, lavatories, urinals, sinks and electric water coolers on carriers.

C. Do not install metal fittings until adjoining tile work has been acid- cleaned. The Mechanical Contractor shall be responsible for the proper protection of fixtures after installation.

D. Connections to exposed plumbing fixtures shall be complete with chrome plated brass nipples, tubing, wall escutcheons, etc.

3.4 ADJUSTING AND CLEANING

A. Prior to final acceptance of the work, Mechanical Contractor shall inspect all faucets, flush valves, stop valves, etc., to determine whether they operate properly and discharge proper quantities of water. Connect any deficiencies to satisfaction of Architect's representative.

B. Thoroughly clean all plumbing fixtures, trim and accessories of all tape, adhesives and other foreign materials prior to final acceptance.

END OF SECTION

SECTION 23 00 00

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work in this Division covers all HVAC work specified in all Division 23 Specification Sections and as illustrated on the HVAC Drawings. Comply with other Division 23 Specification Sections as applicable. Refer to other Divisions for coordination of work with other trades.

B. Provide all labor, materials, equipment, transportation, tools and services, and perform all operations required for, and reasonably incidental to, the providing of mechanical system work described in this Division.

C. Contractor shall include providing instructions and demonstrations of the operation of each installed system in its totality to the Owner. Refer to Division 23 specifications for specific Owner training requirements. As a minimum include training of the Owner's Operating Personnel on:

1. Safety Shut-Down of HVAC Equipment.
2. Sequence of HVAC Equipment Operation.

D. Operation and Maintenance of all HVAC Equipment.

E. The Conditions of the Contract, including the General Conditions and Supplementary Conditions, and Division 1 - General Requirements, apply to work covered by this section.

F. Refer to Specification Section 01 32 16 for “Construction Progress Documentation”.

1.2 RELATED DOCUMENTATION

A. Section 01 62 00: Product Requirements.

B. Section 01 78 03: Execution and Closeout Requirements.

C. Section 01 78 39: Closeout Submittals.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to Substantial Completion, fully instruct the Owner in the operation, adjustment, and maintenance of products, equipment, and systems; including, but not limited to all HVAC equipment, related accessories and components, temperature controls and the energy management system. Owner shall operate all systems in cooperation with Contractor for a period of at least five (5) working days prior to, or shortly after, Substantial Completion.

B. Arrange for services of qualified manufacturer's representatives to fully instruct Owner on specialized portions of installations, such as air handling units and auxiliaries; VAV terminal units, automatic temperature controls, and water treatment systems.

C. Arrange for each installer of equipment that requires regular maintenance to meet with Owner to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by trained manufacturer's representatives. Include detailed review of the following items:

1. Operating and Maintenance Manuals.
2. Record Documents.
3. Spare Parts and Materials.
4. Lubricants.
5. Cleaning.
6. Standard and Extended Warranties.
7. Maintenance Requirements, Agreements, and similar continuing commitments.

D. As a part of these instructions for operating equipment, demonstrate the following procedures:

1. Start-Up.
2. Shut-Down.
3. General System Operating Instructions.
4. Emergency Operating Conditions.
5. Noise and Vibration Adjustments, where applicable.
6. Safety Procedures.
7. Economy and Efficiency Adjustments.
8. Effective Energy Utilization.

E. Return at first change of season for changeover from air conditioning to heating, or from heating to air conditioning, to demonstrate system operation in the opposite season.

F. Submit a complete record of instructions as a part of maintenance instructions and the data book (Operations and Maintenance Manual) given to Owner. For each instructional period, supply the following data:

1. Date of Instruction.
2. System or Equipment Involved.
3. Names of Persons Giving Instructions.
4. Other Persons Present.
5. Time Period (in hours/minutes) Instruction Provided.

G. Amount of time to be devoted to instructional sessions shall be reasonable and consistent with the size and complexity of equipment and systems installed and as specified in other sections of these specifications.

3.2 TEMPORARY WORKING ACCESS

A. Each respective trade shall remove existing piping, equipment, fixtures, and other items to provide access for work in existing facilities and on the site. Contractor shall seek Owner's Representative approval prior to removal of any equipment and mechanical appurtenances.

B. Reinstall and refinish items removed, or otherwise damaged, to match existing adjacent surfaces, or new finishes where applicable, upon completion of the work.

3.3 DISRUPTION OF EXISTING FUNCTIONS

A. Access: Access to and use of the existing facilities and site will be restricted, and shall be under the direction and control of the Owner.

B. Disruptions: Maintain existing mechanical, and other existing systems, and maintain all existing functions in service except for those specific portions scheduled for disruption. Where existing functions to remain in use are disrupted, they shall be fully restored after disruption, in full compliance with this Division of the Specifications for new work, as quickly and as reasonably possible.

C. Scheduling of Disruptions: Seek and obtain approval by the Owner two (2) weeks in advance of each event. Failure to schedule such disruptions in advance will result in the Contractor being stopped or rescheduled by the Owner without added cost to the Owner.

D. Notice of Disruption: Date, time and duration of each disruption shall be subject to the Owner's prior written approval and shall include the following information in the form of a memorandum submitted by the Contractor to the Owner's Representative for approval by the Owner:

Facility/System	Date	Starting Time	Duration

E. Emergency Disruptions: When circumstances preclude obtaining advance approval as specified above; make request immediately on knowledge of the requirement, and perform the work so as to cause the minimum amount of disruption, for the minimum duration.

F. Notification: Notify the Owner's Representative and the Owner immediately, by telephone and then in writing, as changes and additions to the scheduled disruption requirements become known.

G. Duration:

1. Complete as large a portion of the work as possible before initiating disruption.
2. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal services.
3. Keep duration of disruption as short as possible.
4. During the disruption, perform only the amount of work that requires the disruption, so as to minimize duration of disruption.

3.4 MODIFICATIONS AND RELOCATIONS

A. Modify, remove, or relocate materials and items indicated on the Drawings or required by the installation of new facilities.

B. Relocations:

1. Repair and restore to good functional condition, equipment, materials and items scheduled for relocation, which are damaged during dismantling or reassembly operations.
2. Remove carefully, in reverse order to original assembly or placement, items which are to be relocated.
3. Protect items until relocation is complete.
4. Clean and repair items to be relocated, and provide new materials, fittings, and appurtenances required to complete the relocations as required to restore them to good operating order.

C. Perform the relocation work in accordance with applicable Sections of these Specifications, utilizing skilled workers.

3.5 SCHEDULE OF WORK

A. Reference Division 1 for Additional Scheduling Information.

B. Contractor and all system installers for each Section of these Specifications shall realize that the present building houses a completely functioning facility that must continue in full operation 16 hours per day during the construction period. Outages of any kind cannot occur, except only when and as the Owner's Representative or Owner may direct otherwise. Under no conditions shall any work be done in the present building that would interfere with its natural or intended use unless special permission is granted by the Owner.

C. Work under the various specification sections must be expedited and close coordination will be required in executing this work. Various system installers shall perform their portion of the work at such times as directed so as to insure meeting scheduled dates, and to avoid delaying the work of other trades. Owner's Representative will verify scheduled times of work in the various areas involved, each system installer shall cooperate in establishing these times and locations and the system installers shall process their work so as to insure proper execution and completion.

D. Under no conditions shall any work be done in the present building that would interfere with its natural or intended use, unless special permission is granted by the Owner. This is particularly applicable where

new connections are to be made to existing lines, services, or items of equipment in the present building or where existing equipment items or services in that building are to be replaced or modified in any way.

E. Generally, modifications to, replacing of, or making new connections into existing service lines shall be accomplished only during the times directed by the Owner. New lines shall be installed and tested before connections are made into existing lines, meters, or services.

F. All other modifications to existing piping systems and appurtenances, including necessary interconnections between old and new portions of the various systems, shall be accomplished at times scheduled so as not to interfere with the normal use of the building and the existing systems to which connection is to be made.

G. The use of any type of fastening or hanging device which requires the use of shots or explosives of any nature shall not be used. Explosives shall also not be used for any excavation inside an existing building.

H. Where required by conditions at the site, Contractor shall perform portions of work at night or at other such times as may be required to insure completion of work on schedule. No additional compensation to the Contractor will be paid for such work or required utilities.

I. Contractor shall be available, as deemed necessary for job progress by the Owner, for weekly progress and coordination meetings with the Architect, Engineer, and other Owner's Representatives, when required. These meetings shall be used to monitor progress of submittals, receipt of materials, construction progress, cooperation of trades, field coordination by the Contractor, and to resolve unforeseen conditions in an expeditious manner. Failure to attend meetings, to respond in a timely manner to requests for information, or to progress at an acceptable pace to maintain the construction schedule shall constitute a delay by the Contractor and may be cause for assessment of fees to the Contractor as outlined in Division 1.

J. Provide all temporary connections as necessary to facilitate the phasing of construction, even where not specifically shown. Where temporary work is required it may be required that the Contractor produce a Shop Drawing or field sketch to illustrate the intended methods which shall be submitted for approval by the Architect.

3.6 CLEAN UP

A. Remove all debris, rubbish, and materials resulting from construction operations from the work area on a daily basis.

B. Where such work generates dust and debris take all precautions necessary to prevent dust and debris from accumulating in or on mechanical and electrical equipment. This may require adding temporary filter media over ventilation air openings of certain types of equipment.

C. At the conclusion of this work clean all building materials, mechanical equipment and electrical equipment so that all items are dust free and operating properly. Where dust causes damage to equipment the Contractor shall make repairs to this equipment at no cost to the Owner.

D. Transport all materials and equipment indicated above in approved containers and legally dispose of all debris off site in a manner approved by the Architect and Owner.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Conditions of the Contract including the General Conditions, Supplementary Conditions, and Division One, shall apply to work of this Division, whether attached or not.

B. The requirements specified in this Section shall be applicable to work specified in other Sections within this Division.

1.2 SCOPE OF WORK

A. All Division 23 sections of these specifications shall include all labor and material to complete the entire mechanical systems as specified and shown on the Drawings.

B. All work shown and specified shall be completely installed and connected by mechanics properly qualified to perform the work required. All work shall be left in a satisfactory operating condition as determined by the Owner and Owner's Representative.

C. Provide all services and perform all operations required in connection with, or properly incidental to, the construction of complete and fully operating systems with all accessories as herein specified and shown on the Drawings.

D. Refer to "Conditions of Work" in Division 1.

1.3 GENERAL

A. The accompanying Drawings show diagrammatically the sizes and location of the various equipment items and the sizes of the major interconnecting piping and ductwork, without showing exact details as to elevations, offsets, control lines, and other installation details. The Contractor shall carefully lay out his work to conform to the site conditions, to avoid obstructions and provide proper grading of lines. Exact locations of outlets, apparatus, and connections thereto shall be determined by reference to the Drawings, reviewed Shop Drawings, including equipment drawings, and rough-in drawings, by measurements at the building, and in cooperation with work specified in other sections of these specifications. Minor relocations necessitated by the conditions at the site or directed by the Architect shall be made without any additional cost to the Owner.

B. These specifications and the accompanying Drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will insure complete and satisfactorily operating installations. Contractor shall coordinate the proper fitting of all material and apparatus into the building and shall prepare larger scale installation drawings for all critical areas, areas with limited working clearances, and areas of significant congestion requiring a higher level of coordination illustrating the installation of work specified in Division 23 in relation to all other portions of work specified in other Sections of these Specifications. Interferences with other portions of work, or the building structure, shall be corrected before any work proceeds. Should changes become necessary on account of the failure of the Contractor to comply with these stipulations, Contractor shall make all necessary changes at no expense to the Owner.

C. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted on the Drawings.

D. It is the intent of the Contract Documents to provide an installation complete and operational in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section, or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems and required to complete the installation.

E. Contractor sets forth that all personnel have the necessary technical training and ability; and that all work specified in this Division will be installed to the best standard of each trade, and will be complete and in good working order. If any of the requirements of the Drawings and specifications are impossible to perform, or if the installation when made in accordance with such requirements will not perform satisfactorily, report same to the Architect promptly after discovery of the discrepancy.

F. No extra compensation will be allowed for extra work or changes caused by failure to comply with the above requirements.

1.4 EXAMINATION OF THE SITE

A. Contractor shall visit the site, verify all items indicated on the Drawings or specified, and familiarize himself with the work conditions, hazards, grades, actual formations, soil conditions, points of connection, utility locations, and local requirements.

B. Contractor shall take these conditions into consideration, and the lack of specific information on the Drawings shall not relieve the Contractor of any responsibility.

C. All site visits shall be coordinated and scheduled with the Owner.

1.5 CUTTING AND PATCHING

A. Excessive cutting of the building structure, walls, floors, ceilings, roof, etc., will not be permitted. No structural member shall be notched or cut unless specifically shown on the Drawings, or unless such cutting is authorized by the Architect.

B. Provide for all holes or openings of proper size and shape as may be necessary for the proper installation of work specified in Division 23, consulting with the Architect regarding proper locations and sizes.

C. Where deemed necessary, and after consulting with the Architect, perform all cutting and patching required for the installation of piping, ductwork, etc. This shall include the cutting of concrete floors, concrete and tile floors, walls, ceilings, roofs, etc. It shall also include patching them as required to restore work to match existing finishes, following installation, testing, backfilling, insulation, etc.

D. Holes through concrete shall be drilled with "Mole", "Core-It', or other diamond point hole saw.

E. Refer to Section 01 73 29, Cutting and Patching.

1.6 CODE REQUIREMENTS

A. Contractor is required to comply with the requirements of all National, State, and local codes and utility companies having jurisdiction. In no case does this relieve the Contractor of the responsibility of complying with the requirements of these specifications and Drawings where specified conditions are of higher quality than the requirements of the above specified offices. Where requirements of the specifications and Drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above offices and shall notify the Architect promptly.

B. Contractor shall comply with the requirements and standards set forth by, but not limited to, the following:

1. (NFPA) National Fire Protection Association.

2. (OSHA) Occupational Safety and Health Administration.
3. (NEC) National Electric Code.
4. (IECC) International Energy Conservation Code.
5. Local Plumbing Code.
6. Local Building Code.
7. Local Mechanical Code.
8. Local Fire Code.
9. Local Energy Code.

C. Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction. Fees and costs incidental to these permits, inspections, and approvals must be assumed and paid by the Contractor.

1.7 RECORD DRAWINGS

A. Contractor shall, during the execution of work, maintain a complete set of “Record Drawings” upon which all locations of equipment, ductwork, piping, and all deviations and changes in the work shall be neatly recorded for use in producing "As Builts" at Project Close- Out. This shall include the incorporation of all Supplemental Drawings issued during the Construction Period.

B. All “Record Drawings” shall be reviewed monthly during the Construction Period, along with the monthly Pay Application Request.

C. Refer to Section 01 78 39, Project Record Documents.

1.8 RECORDS AND INSTRUCTIONS FOR OWNER

A. Accumulate during the job's progress the following sets, in triplicate, in accordance with the provisions of Section 01 78 23 & 01 78 39:

1. Warranties and guarantees and manufacturer's directions on equipment and material covered by the Contractor.
2. Equipment and fixture brochures, wiring diagrams, and control diagrams.
3. Copies of reviewed Shop Drawings, and material and equipment submittals. Copies of rejected submittals and Shop Drawings are not to be provided.
4. Operating instructions for heating and cooling and other mechanical systems. Operating instructions shall include recommended maintenance and seasonal change-over procedures.
5. Other data and drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. "As-Built" Record Drawings shall be provided in electronic format on a CD (provide two (2) copies) in a PDF or DWG format as determined by the Owner.
8. Provide copies of all City Inspection Certificates of Approval.
9. Provide Contractor's Certification Statement that all equipment furnished and all work performed is in compliance with all applicable codes referenced in these specifications, or those which are currently in effect.

B. Provide not less than one (1) days of operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of all equipment.

C. All of the above data should be submitted to the Architect for approval at such time as the Contractor asks for his last payment request, just prior to his final payment request. In no case will any portion of retainage be released until these documents are submitted and accepted.

D. Refer to related portions of Division 1 for Project Close-Out requirements, Operation and Maintenance Data, Warranties, and other related certificates.

1.9 SHOP DRAWINGS AND SUBMITTALS

A. Contractor shall submit to the Architect shop drawings, product submittals, and catalog data on all ductwork, equipment, and materials designated on the Drawings and specified herein. A minimum of four (4) hard copies or one (1) electronic copy of each shall be submitted or submittal shall be transmitted electronically. Additional copies will be required when indicated by the Architect and as required for project coordination.

B. Each submittal will be reviewed for compliance with general requirements of design and arrangement only; it is not a contract document and acknowledgement of compliance does not relieve the Contractor from responsibilities for performance of the work in compliance with all provisions and requirements of the Contract Documents. Job measurements and the coordination of all dimensions for proper fit of all parts of the work and performance of all equipment supplied to meet specification requirements are, and remain, specific responsibilities of the Contractor.

C. Shop Drawings shall be furnished by the Contractor for the work involved after receiving approval on the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job, and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary detailed drawings. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary; and, should there be any charges in connection with this, they shall be borne by the Contractor.

D. Shop Drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission on individual items shall designate the exact item offered and accessories as specified.

E. Shop Drawings are not intended to cover detailed quantitative lists of heating specialties, valves, air distribution devices, fixtures, and similar items, as the Drawings and specifications illustrate those items; and it is the Contractor's responsibility to procure the proper quantities required to comply with the established requirements.

F. Shop Drawings prepared to illustrate how equipment, piping, ducts, etc., can be fitted into available spaces will be examined under the assumption that the Contractor has verified the conditions shown. Review by the Architect shall not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those Shop Drawings.

G. Various material submissions of such items as air devices, plumbing fixtures, drains, and other related items or accessories shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets. Cover sheets for each item submitted shall have sufficient bare space to allow for shop drawing review stamps.

H. Contractor shall process his submitted data to insure that it conforms to the requirements of the Drawings and specifications, and there are no omissions and/or duplications.

I. Shop Drawings and Submittals shall be accompanied by certification from the Contractor, and firm preparing such, that Shop Drawings have been checked for, and are in compliance with, the Contract Documents.

J. All Submittals and Shop Drawings shall have been submitted for review by the Architect and Engineer within 90 days after Contract Award Date.

1.10 PENETRATIONS THROUGH FIRE-RATED ASSEMBLIES

A. Seal voids around ducts and pipes penetrating fire-rated assemblies and partitions using fire-stopping materials and methods in accordance with provisions in Section 07 84 00, Fire-Stopping.

1.11 DRAWINGS

A. Drawings show diagrammatically the locations of the various pipes, ductwork, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building, and in full cooperation with work specified in other Divisions of these specifications; and, in all cases, shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in the location of any of this work without additional cost to the Owner.

B. Should any changes be deemed necessary in items shown on the Contract Drawings, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Architect for approval.

C. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention prior to bids being submitted; otherwise, the Contractor shall be responsible for the cost of any and all changes and additions that may be necessary to accommodate the installation of any particular apparatus.

D. Lay out all work maintaining all lines, grades, and dimensions according to these Drawings with due consideration for the work of others. Verify all dimensions at the site prior to any fabrication or installation. Should any conflict develop or installation be found impractical, the Architect shall be notified before any installation or fabrication, and the existing conditions shall be investigated and proper changes effected without any additional cost.

E. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of materials and work. The Architect does not assume any responsibility, either direct or implied, for omissions or duplications by the Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.

1.12 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. Equipment supplied as portions of work specified under other Divisions of these specifications shall be furnished with proper roughing-in diagrams and shall be installed as a part of Division 23.

B. Furnish materials and labor required for the connection of this equipment.

C. Contractor shall ascertain that all equipment so specified is included as part of this work.

1.13 COOPERATION

A. Coordinate all work indicated in Division 23 with work specified in other Divisions to assure proper and adequate interface with other portions of the work.

B. Maintain contact and be familiar with the progress of the general construction and the timely installation of sleeves and inserts, etc., before concrete is placed. Install the required systems in their several stages, at the proper time to expedite the work and avoid unnecessary delays in the progress of other portions of the work.

C. Should any questions arise between work specified in Division 23 with respect to other portions of work specified in other Divisions of the Specifications, reference shall be made to the Architect for instructions.

1.14 MATERIALS AND EQUIPMENT

A. All materials and equipment purchased shall be new. No used or reconditioned equipment will be allowed.

B. Substitutions: Products of same functions, performance and design will only be considered if in full accordance with the requirements of Section 01 62 00, Product Options. The products of other manufacturers will be acceptable; only if, in the opinion of the Architect, the substitute material is of a quality as good or better than the material specified, and will serve with equal efficiency, maintainability, and dependability, the purpose for which the items specified were intended.

C. Listed Manufacturers:

1. Manufacturers listed in a product or system specification are those manufacturers considered capable of manufacturing products conforming to the specification requirements, and are listed therein to establish a standard.
2. The "listing" of a manufacturer does not imply "acceptance" or "approval" of any standard product of that manufacturer.
3. Products offered by listed manufacturers shall be equal to, or superior in all respects to, that specified by named products; and shall meet or exceed specification requirements.
4. The description of specific qualities takes precedence over the reference standards and the description of qualities and reference standards together take precedence over the named product of listed manufacturers.

D. Product Options:

1. Products specified only by Reference Standards or by Description only means that any product meeting those standards or descriptions, by any manufacturer, will be considered.
2. Products specified by naming several products or manufacturers means that only the manufacturers named will be considered.
3. Products specified by naming only one product and manufacturer means that no option exists unless a substitution is accepted. Submit a request for substitution for any product or manufacturer not specifically named.
4. Products specified by Description, Reference Standard, and naming several products or manufacturers means that any product and manufacturer named meeting those descriptions and standards will be considered. Submit a request for substitution for any product or manufacturer not specifically named.

E. Limitations or Substitutions:

1. During Bidding Period, Instructions to Bidders, in Division 1, will govern times for submitting requests for substitutions under requirements specified in this Section.
2. No later than ten (10) days prior to the bid date, Contractor shall notify the Architect in writing of any desired substitutions of products in place of those specified. These requests will be considered; and, if a favorable response is determined, this will be documented in the form of an Addenda.
3. Substitutions will not be considered when indicated or implied on Shop Drawings or product data submittals without separate formal request, when requested directly by subcontractor or supplier, or when acceptance will require substantial revision of Contract Documents.
4. Substitute products shall not be ordered or installed without written acceptance.
5. Only one request for substitution for each product will be considered. If substitution is not accepted, Contractor shall provide specified product.
6. Architect will determine acceptability of any and all substitutions.

F. It is fully the Contractor's responsibility to assemble and submit sufficient technical information to fully illustrate that the material or equipment proposed for substitution is equal or superior, as the Architect is under no obligation to perform the service for the Contractor. The proposal shall be accompanied by manufacturer's engineering data, specification sheet, and a sample, if practical or if requested or specified. In no event shall a proposal for substitution be cause for delay of work. This shall include a detailed comparison to each product specification paragraph.

G. Should a substitution be accepted under the above provisions, and should the substitution prove defective or otherwise unsatisfactory for the intended service, within the warranty period, the Contractor shall replace the substitution with the equipment or material specified, and on which the specifications required him to base his proposal.

H. No substitutions will be considered contingent upon pending certification and rating agency approvals. Such certifications and ratings shall be in effect at the time of bidding.

1.15 EQUIPMENT SIZES AND REQUIREMENTS

A. Space allocations in machinery and mechanical equipment spaces are based on equipment scheduled in each case. Should the Contractor request a substitution for equipment of another make that requires more space in any critical dimension, the Contractor shall submit, together with other submittal data on the equipment, prints of drawings indicating how the equipment may be installed, indicating room for servicing and revisions in piping or ducting and any other details necessary for the Architect to form a judgement as to the suitability of the substitute material, as to performance, suitability for the space and other variables.

B. Duties of certain equipment items, horsepowers of driving motors and electrical characteristics are scheduled for equipment items of a particular make in each case. Should requests for a substitute material be accepted which has other requirements that would involve allied equipment or other portions of work, the Contractor shall be responsible for all modifications required at no change in contract price. As examples:

1. If an accepted A/C Unit has a brake horsepower requirement above the motor horsepower scheduled, the Contractor shall be responsible for providing a larger motor and heavier drive and any change in size of the protective device, conduit run and conductors serving that motor. The latter shall be extended through an individual branch protective device and branch circuit on through the panel, feeder, feeder protective device, etc.
2. If accepted, heat exchangers, coils, etc., having greater pressure drops than those on which pumping heads were based, the Contractor shall be responsible for selecting proper pumps and drives and adjusting electrical service work accordingly.

C. Structural steel members are indicated to provide supports for certain specific sizes and weights of equipment. Should a substitution request involve other equipment, the spacing of the supports shall be varied to suite the equipment. Should the weight or size of a proposed substituted item of equipment require additional supporting steel members, the Contractor shall include documentation of the additional supports in the request for substitution and install them at no change in contract price if the substitution is accepted.

D. Various large apparatus to be installed may require that the apparatus be installed prior to the installation of portions of structural, walls, or door frames. Coordinate the installation of these items to insure that no demolition of general construction is necessary for equipment installation or that the apparatus does not have to be disassembled for installation.

1.16 STORAGE AND PROTECTION OF MATERIALS

A. Store and protect materials and equipment as specified in Section 01 66 00, Product Storage and Handling Requirements.

B. Contractor shall provide storage space for protection and storage of his materials and assume complete responsibility for all losses due to any cause whatsoever. All storage shall be within the property lines of the building site, and as directed by the Architect. In no case, shall storage interfere with traffic conditions in any public or project thoroughfare.

C. All work and material shall be protected at all times. Contractor shall make good any damage caused, either directly or indirectly, by his workmen. He shall be responsible for safe handling of all mechanical equipment and shall replace, without charge, all items damaged prior to acceptance by the Owner.

D. On site storage shall not be inside the building during construction progress, but shall be in approved trailers or as specifically approved otherwise by the Architect. Storage inside the building shall only be allowed when so allowed by the Architect.

1.17 FOUNDATIONS

A. Provide equipment foundations associated with the work specified in Division 23.

B. All top corners and edges of all foundations shall be neatly chambered at a one inch (1") high 45 degree angle.

C. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling, and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary.

D. After removal of the forms, the surface of the foundation shall be rubbed until smooth.

E. Unless otherwise noted, foundations shall be four inches (4") thick elsewhere for low pressure rated air handling units and other mechanical equipment, unless specifically noted otherwise on the Drawings.

F. All concrete work shall conform to the requirements of Section 03 30 00, Cast-in-Place Concrete.

G. Provide housekeeping pads and foundations for every item of floor mounted equipment specified in Division 23 specifications. Pads shall be a minimum of 4 inches thick extend a minimum of two inches (2") in each direction beyond the equipment size.

1.18 EXCAVATION AND BACKFILLING

A. Contractor shall do all necessary excavating and backfilling for the installation of his work. Trenches for underground conduits shall be excavated to required depths with bell holes provided as necessary to insure uniform bearing. Care shall be taken not to excavate below depth, and any excavation below depth shall be refilled with sand or gravel firmly compacted. Where rock or hard objects are encountered, they shall be excavated to a grade six inches (6") below the lowermost part of the piping and refilled to grade as specified. After the piping has been installed and reviewed by Architect and local building authorities, trenches shall be backfilled to grade with approved materials, well tamped or puddled compactly in place. Where streets, sidewalks, etc., are disturbed, cut, or damaged by this work, the expense of repairing same in a manner approved by Architect shall be a part of this contract.

B. Contractor shall bear sole responsibility for design and execution of acceptable trenching and shoring procedures, in accordance with State of Texas Regulations. On trench excavations in excess of five feet (5') in depth, Contractor shall pay a qualified engineer to prepare detailed Drawings and specifications directing Contractor in the safe execution of trenching and shoring. It is understood that trench safety systems constitute a means and method of construction for which the Architect, Engineer, and Owner are not responsible. Accordingly, such documents when prepared, shall be separately issued by Contractor's Consultant, independent of project contract Documents.

1.19 WIRING

A. Unless otherwise noted, all wiring for motors, starters, and equipment is specified in Division 26.

B. Wiring of temperature controls shall be performed in accordance with the requirements of Division 26 but shall be performed as outlined in other sections of these specifications.

C. All power for control circuits required for the Temperature Control System shall be provided and installed where indicated on the Division 26 Drawings, but shall otherwise be provided as indicated in other sections of these specifications.

D. Each supplier of equipment requiring control shall have wiring diagrams furnished with submittals. This shall be used to determine conduit layouts required to complete the electrical portions of the instrumentation and control systems.

E. All motors furnished as a portion of work specified in Division 23 shall be wired as specified in Division 26.

F. Except where combination starter-disconnects are specified elsewhere herein or in Division 16, all motors shall be provided with safety disconnect switches in accordance with the National Electrical Code as specified in Division 26.

G. Furnish all necessary wiring diagrams for equipment specified in Division 23, as a part of equipment submittals, for installation under other sections of these specifications.

1.20 EQUIPMENT STANDARDS

A. All basic materials and equipment shall be standard catalog products of a reputable manufacturer and shall essentially duplicate equipment which has been in satisfactory service for at least one (1) year.

B. First of a kind new technology devices will not be considered.

C. Accessory equipment that is required to make a complete and functioning system that is not of the same manufacturer furnishing the basic materials or equipment shall carry the guarantee of the basic material or equipment manufacturer and repair and replacement parts shall be available through normal trade channels locally.

1.21 DEHUMIDIFICATION OF BUILDING

A. It shall be the Contractor's responsibility to properly and thoroughly dry out all building materials used for construction of the building, as well as to dry out the building and dehumidify the spaces prior to activating the HVAC System. Extra precautions should be taken by the Contractor not to allow excessive humidity to develop in the building prior to final connection and activation of the HVAC System. Should it become necessary, the Contractor shall procure the required equipment (multiple portable dehumidifiers, as required to include temporary power thereto) to properly dry and dehumidify the building materials and spaces so as not to force the HVAC System to perform beyond its intended abilities.

B. Contractor shall be responsible for all costs in connection with repair and/or activation to the building and its HVAC Systems should excess moisture cause damage thereto.

C. Contractor shall provide proof of dehumidification by furnishing temperature and humidity readings for each section of the building as measured and recorded by an independent agent approved by the Owner/Architect. Provide these readings to the Owner's representative prior to the building HVAC system being activated and also furnish with the Project Close-Out documents.

D. The inside building Dew Point shall not exceed 55 Deg.F. for a period of 24 consecutive hours or for a total of 24 hours in a 7 day time period.

1.22 CLEAN UP

A. Contractor shall be responsible for cleaning up after and during all work performed under this Division of the Specifications.

B. Contractor shall, on a daily basis, remove construction trash and debris accumulation to minimize the entrance of dust, dirt, and debris in piping, ductwork, and mechanical equipment.

C. At the completion of construction, just prior to Substantial Completion and sustained operation of equipment, thoroughly clean the inside of piping, ductwork, and equipment.

D. Refer to Division 1.

1.23 FINAL CONSTRUCTION REVIEW

A. Schedule: Upon completion of the work specified in Division 23, there shall be a final construction review of the completed mechanical systems installations. Prior to this walk-thru, all work specified in this Division shall have been completed, tested, adjusted, and balanced in its final operating condition and the preliminary test report shall have been submitted to and approved by the Architect.

B. Personnel: A qualified person representing the Contractor must be present at this final construction review to demonstrate the system and prove the performance of the equipment.

C. Building mechanical systems shall have been in operation for a minimum of 15 days and Test and Balance work shall be substantially complete prior to this review.

D. Exceptions to the aforementioned requirements will be considered on a case-by-case basis dependent on the size and type of project, as well as construction schedule limitations.

1.24 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications.

B. Provide copies of all applicable approved notices and inspection certifications from the various inspections conducted by the Local Code Enforcement Authorities.

1.25 GUARANTEE

A. The guarantee provision of this specification requires prompt replacement of all defective workmanship and materials occurring within one year of final job acceptance, Substantial Completion, or as defined by Extended Warranty Contracts. This includes all work required to remove and replace the defective item and to make all necessary adjustments to restore the entire installation to its original specified operating condition and finish at the time of acceptance.

B. The Contractor shall also guarantee that the performance of all equipment furnished and installed under this Division of the Specifications shall be at least equal to the performance as called for in the specifications and as stated in the equipment submittals. Should there be indication that the equipment and installation is not producing the intended conditions, the Contractor shall make further tests as the Owner's Representative may direct to demonstrate that the equipment installed meets the specifications and is delivering the capacity specified or called for on the Drawings.

C. If there is any indication that the equipment does not meet the specified quantities, the Contractor shall, at his expense, institute a program to demonstrate the adequacy of the installation. This program shall include all necessary testing and testing equipment. Should the Contractor not have the equipment or technical skill to perform the tests, it shall be his responsibility to employ recognized experts to perform the tests and shall provide certified laboratory tests, certified factory reports and work sheets, or other certified data to support results of any tests required.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with Division 23 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

1.2 SYSTEM DESCRIPTION

A. Provide motors for all mechanical equipment furnished under Division 23, as indicated herein and as illustrated on the Contract Drawings.

B. All motors shall be of the same manufacture for like pieces of equipment; i.e., air handling units shall have motors of the same manufacturer. Pumps shall have motors of the same manufacturer, but both types of equipment are not required to have the same motor manufacturer.

C. The following equipment with 3 phase 1 horsepower motors or larger shall be provided with NEMA Premium efficiency motors as specified herein:

1. Fans.
2. Roof Top Units.

D. Three phase, horizontal, NEMA frame induction motors served by AC Adjustable Frequency Motor Controllers shall be designed to meet the intent of NEMA MG1, Part 31, Section 31.40.4.2 regarding voltage spikes without exception.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 23 and 23 05 00.

B. Indicate on submittal the motors proposed for each system of equipment to be installed. This shall be in tabular form in one location for each type of equipment submitted. The lack of this information will be grounds for rejection of equipment submittals.

C. Product Data shall be furnished which shall include:

1. Motor Manufacturer.
2. Motor Type; Open Drip Proof, Totally Enclosed (Fan Cooled or Air Over).
3. Model of Manufacturer.
4. Motor Horsepower.
5. Motor RPM.
6. NEMA Motor Efficiency at 25%, 50%, 75%, and 100% of Full Load Rating for motors served by variable frequency drives; 100% only for constant speed motors 1 HP and larger.
7. Power Factor at 25%, 50%, 75%, and 100% of Full Load Rating for motors served by variable frequency drives; 100% only for constant speed motors 1 HP and larger.
8. Service Factor.

D. Certification: Provide manufacturer's literature indicating NEMA premium motor efficiency as tested in accordance with IEEE Standard 112, Test Method B. Provide documentation to verify motors served by variable frequency drives meet NEMA MG1, Part 30 for 6-step drives and Part 31 for PWM drives.

E. Provide closeout documents as required in Division 1.

1.4 QUALITY ASSURANCE

A. Comply with all regulatory requirements in the following order of precedence:

B. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing, including local codes.

C. Provisions specified in this Section of Specifications.

D. Applicable provisions of standards of National Electric Code (NEC).

E. Manufacturer shall have been manufacturing the motors as described herein for a minimum of ten (10) years.

PART 2 - PRODUCTS

2.1 ELECTRICAL MOTORS, GENERAL

A. All motors furnished under any of the several sections of these specifications shall be of a recognized manufacturer, be of adequate capacity for the loads involved, and wound for the electrical characteristics indicated on the Drawings and specified herein. Verify all job site voltages and power source available before submitting, ordering and installing any motor or related controls.

B. Motors shall conform to the standards of manufacture and performance of the National Electrical Manufacturer's Association (NEMA) as shown in their latest publication.

C. Motors shall be furnished with an open-frame, unless otherwise noted, or required by the NEC for the service conditions encountered. Motors exposed to weather shall be the totally enclosed type suitable for installation in ambient conditions for exposure to the sun, heat, and rain. Provide explosion proof motors where indicated and as required for the hazard in which to be installed.

D. Unless otherwise noted, fractional motors rated at 1/2 horsepower and less shall be single phase, the motors rated at larger than 1/2 horsepower shall be three phase. Single phase motors shall be arranged for across-the-line starting.

E. Single phase motors shall be capacitor start, induction run type, and shall be furnished with motor controller with pilot light where scheduled or indicated. Refer to Section 23 05 14.

F. All motors shall be of the same manufacturer on similar equipment furnished by the same manufacturer, unless they are an integral part of the piece of equipment to which they are attached, such as a chiller. Air Handling Units shall have motors of the same manufacture and pumps shall have motors of the same manufacture; but, pumps and air handling units are not required to have motors of the same manufacturer.

G. Three phase motors shall generally have the following characteristics:

1. All copper windings.
2. Type K, NEMA Design "B".
3. Normal Starting Torque.
4. Class B insulation.
5. Continuous Duty Rated.
6. 40 Deg. C. ambient rated.
7. Minimum 1.15 Service factor on motors 1 horsepower and larger; 1.25 service factor on motors 3/4 horsepower and smaller.
8. 1800 RPM unless scheduled otherwise.
9. Oversize steel conduit boxes.
10. Greasable bearings.
11. Stainless steel or aluminum motor nameplates for standard motor information.
12. Cold rolled steel 1045 shaft.

13. Steel frame and splash cover.

H. Where other sections of specifications do not call for premium efficiency motors this section shall apply to motor requirements. Where premium efficiency motors are required in the other Sections of these Specifications refer to Article 2.2 herein.

I. Motor manufacturers shall be Reliance, Baldor, General Electric, A.O. Smith or U.S. Motors. Other manufacturers will not be considered.

2.2 PREMIUM EFFICIENCY ELECTRICAL MOTORS

A. All premium efficiency electrical motors furnished under any of the several sections of these specifications shall be of a recognized manufacturer, be of adequate capacity for the loads involved, and wound for the electrical characteristics indicated on the Drawings and specified herein. Verify all job site voltages and power source available before submitting, ordering and installing any motor or related controls.

B. Motors shall conform to the standards of manufacture and performance of the National Electrical Manufacturer's Association (NEMA) as shown in their latest publication.

C. Motors shall be furnished with an open-frame, unless otherwise noted, or required by the NEC for the service conditions encountered. Motors exposed to weather shall be the totally enclosed type suitable for installation in ambient conditions for exposure to the sun, heat, and rain. Provide explosion proof motors where indicated and as required for the hazard in which to be installed.

D. All NEMA Premium efficiency motors shall be three phase.

E. Except as otherwise specified NEMA Premium efficiency motors shall be drip-proof, squirrel cage, premium efficiency type as manufactured by A. O. Smith (E Plus III), Baldor (Super E), Reliance (Duty Master XE), General Electric (Energy Saver), or U.S. Motors Premium Efficiency NEMA Design B, induction type rated for constant duty with 40 Deg. C. ambient temperature rise. The motors shall have the following characteristics:

1. 1800 RPM unless scheduled otherwise.
2. 1.15 Service Factor.
3. Rigid base.
4. Serialized and certified.
5. Stainless steel nameplate.
6. Class B insulated.
7. 60 Hertz.
8. High power factor.
9. Ball Bearings.

F. Totally enclosed motors and motors served by variable frequency drives shall be Class F insulated.

G. Minimum Nominal motor efficiencies at 1800 RPM, 460V, 4 pole, full-load, per IEEE Standard 112, test method B, as defined by NEMA MG1-12.53, a and b, shall be as follows, along with minimum power factor:

MOTOR HP	NOMINAL EFFICIENCY		POWER FACTOR	
	TEFC	ODP	TEFC	ODP
1	85.5	85.5	84.0	84.0
1.5	86.5	86.5	85.7	85.7
2	86.5	86.5	85.7	85.7
3	89.5	89.5	85.5	85.5
5	90.2	89.5	88.0	88.0
7.5	91.0	91.0	82.0	82.0
10	91.7	91.7	82.0	82.0
15	92.4	93.0	86.0	83.5
20	93.0	93.0	86.5	84.5
25	93.0	93.6	87.5	87.0
30	93.6	94.1	88.5	87.0
40	94.1	94.1	89.0	87.0
50	94.5	94.5	88.5	86.5
60	95.0	95.0	87.0	84.5
75	95.4	95.0	87.0	85.0
100	95.4	95.4	86.0	86.0
125	95.4	95.4	88.0	88.0
150	95.8	95.8	85.5	85.5
200	96.2	95.8	86.0	86.0

H. Furnish submittal data on all NEMA Premium efficiency motors furnished to include motor efficiencies as rated in accordance with IEEE Standard 112, Test Method B.

I. All motors shall be of the same manufacturer on similar equipment furnished by the same manufacturer, unless they are an integral part of the piece of equipment to which they are attached, such as a chiller. Air Handling Units shall have motors of the same manufacture' and pumps shall have motors of the same manufacture; but, pumps and air handling units are not required to have motors of the same manufacturer.

J. Each premium efficiency motor shall be warranted for a minimum of three (3) years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Motors shall typically be furnished by the manufacturer of the equipment which the motor will serve.

B. Motors shall be factory installed in the equipment and be mounted on equipment bases, wired to a terminal box, connected to the mechanical device to be rotated, and factory run tested.

C. When project schedules will not allow the above due to excessive lead time requirements, the Contractor shall do one of the following all at no additional cost:

1. Locally procure the specified motors, while meeting all of the above requirements, and field install the motors on the equipment in accordance with the manufacturer's installation instructions.
2. Accept factory installed standard efficiency motors and replace with high efficiency motors as noted above.

D. Motors disconnects will be furnished and installed under Division 26, unless integral with, or specified to be a part of, the equipment as indicated elsewhere in other sections of these Specifications. The wiring

to the motor and installation of the motor controller, if not specified to be integral with the equipment, as furnished under other sections of these specifications, shall also be installed under Division 26.

E. Interlock and control voltage wiring shall be installed as outlined in other Sections of these Specifications.

END OF SECTION

SECTION 23 05 14

COMMON MOTOR STARTER REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with Division 23 Sections, as applicable. Refer to other Divisions for coordination of work with other trades, as required.

1.2 SYSTEM DESCRIPTION

A. Provide a complete system of motor starters as indicated herein and as illustrated on the contract Drawings.

B. Provide other devices as indicated for control of motors and interface with automation or control systems, and as further required by the local authorities having jurisdiction.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 23 05 00.

B. Indicate on submittal the starter type proposed to be used for each system and for the various sizes of motors required to be installed. This shall be in tabular form with attached cut sheets.

C. Product Data:

1. Snap Action Manual Motor Starters.
2. Magnetic Across-the-Line Motor Starters.
3. Control Transformers.
4. Hand-Off-Automatic Switches.
5. Pilot Lights.
6. Number and Type of Auxiliary Contacts.
7. NEMA Enclosure Type.
8. Power and Control Wiring Diagrams.

D. Provide closeout documents as required in Division 1 at Substantial Completion.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in following order of precedence:

1. Codes, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over installation, inspection, and testing, including local codes.
2. Provisions specified in this Section.
3. Applicable provisions and standards of the National Electric Code (NEC).

B. Manufacturer shall have been manufacturing the product proposed to be used as described herein for a minimum of ten (10) years; or it shall essentially duplicate a product line that has been manufactured for that length of time.

C. Source Quality Control:

1. Manufacturer's tests to meet applicable Underwriters' Laboratories, Inc., Standards.
2. Equipment designed and manufactured to meet applicable ANSI, NEMA, and IEEE Standards.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. Except as specified otherwise, a starter providing overload protection shall be furnished with each motor provided in Division 23, under this section of the specifications, unless:

1. Starters are supplied as an integral part of the specified piece of equipment, such as chillers or boilers; or
2. Starters are provided as specified for a variable frequency motor controller, or
3. Starters are provided in Division 26 as part of a motor control center, or
4. Starters are furnished under Division 26 as a combination motor starter-disconnect.
5. Disconnects on fractional horsepower motors are not substitutes for a motor controller (starter). However, a motor controller on these size motors may substitute for a disconnect only where the required location for both is in the same location.
6. Fractional horsepower motors on VAV terminals are not required to have motor starters furnished herein.
7. Unit heater and ceiling fan fractional horsepower, motors, 1/8 HP or smaller, with inherent thermal overload protection are not required to have motor starters.

B. Each starter furnished herein shall have a NEMA horsepower capacity rating within the required limits of the motor which it serves.

C. Unless otherwise indicated, starters mounted indoors shall be furnished with NEMA Type 1 enclosures, and those exposed to the weather shall be furnished with NEMA Type 3 enclosures.

D. Each three phase starter shall be provided with three thermal overload protection relays, one in each phase, be of the full voltage, across-the-line, non-reversing, single or two-speed, magnetic controller type. Overload relays shall be reset from outside the starter enclosure by means of an insulated bar or button.

E. Starters shall have auxiliary contacts as required to comply with provision for electrical interlocks as defined hereinafter. Provide a minimum of one (1) normally open (N.O.) and one (1) normally closed (N.C.) auxiliary contacts with each three (3) phase starter. Where used, the secondary side of the control transformer shall be grounded and the other side shall be fused. Where starters are interlocked, the starter holding coils shall be of one voltage. Where starter line voltages are different and above 120 volts to ground, provide control voltage transformers in the starters that are interlocked. The control systems installer shall supply all electrical power supply and transformers as needed to serve control circuit requirements for temperature controls. Control voltage in each starter shall be not more than 120 volts to ground, with an individual control transformer provided in each interlocked starter. Control safety circuits shall de-energize the respective motors served via holding coils in the respective starter.

F. Manual starters for fractional horsepower single phase motors shall be on-off, or snap action switch type combined with thermal overload device. The switch shall be so constructed that it cannot be held closed under a sustained motor overload. This shall be equal to an Allen Bradley No. 600-TAX216, toggle switch with neon pilot light and NEMA 1 enclosure unless indicated otherwise for severe duty.

G. Provide starter covers with Hand-Off-Auto Switch and pilot light where equipment is interlocked or remotely controlled. Provide starter covers with Start-Stop buttons and neon pilot lights where equipment is locally controlled.

H. The Hand-Off-Auto Switches shall be so wired that, when in automatic position, the control of their motors is transferred to the control system as outlined elsewhere herein; and, when in hand position, they themselves assume control of their motors irrespective of the remainder of the equipment, although the temperature control sequences shall operate the same while in either the "Hand" or "Auto" position. Safety devices will not be bypassed when in "Hand" position.

I. Coordinate the purchase of all starting equipment, insofar as practical, such that all starting equipment on the project shall be of the same manufacturer.

J. Starters shall be a regularly manufactured product to meet the intent of all requirements specified herein.

K. Acceptable starters and controllers shall be manufactured by

1. Allen-Bradley.
2. General Electric.
3. Cutler-Hammer.
4. Square D.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All starters furnished under this section of the Specifications shall be installed under Division 26 of the specifications.

B. Securely mount all starters level against walls where shown to be fully accessible and convenient for use. Where not specifically shown locate in a convenient and fully accessible location in a Mechanical Room, Electrical Room, Janitor Closet, Storage Room or above accessible lay-in ceiling when no higher than six inches (6") above the finished ceiling height and mounted to a wall or physically secure and stable surface.

C. Where no wall exists for installation, furnish a unistrut fabricated stand secured to the floor, or other suitable structure. Use corrosion resistant fasteners.

D. Where motor starters are ganged together, mount, insofar as is practical, all at the same distance from the floor, or other referenced point, to the bottom of the starters.

E. Refer to manufacturer's wiring diagrams for proper wiring procedures.

F. Wire all safety devices in series to be active in both the "Hand" and "Auto" position.

G. Coordinate starter type and size with motor manufacturer's data for equipment actually installed.

H. Field verify correct sizes of replaceable thermal overload elements for each motor actually installed. Do not over or under size elements.

END OF SECTION

SECTION 23 05 15

VARIABLE FREQUENCY MOTOR CONTROLLERS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 23 Sections as applicable. Refer to other Divisions for coordination of work with other portions of the work.

1.2 SYSTEM DESCRIPTION

A. Furnish and install variable frequency motor drives (controllers) to provide motor speed control for air handling, pumping and cooling tower systems as indicated on the drawings or as scheduled for equipment with all apparatus, specialties, controls, etc., to make the systems complete.

B. Drives shall all typically be the Pulse-Width-Modulated (PWM) AC type drives. Three phase input power shall be converted to a sine-coded, variable frequency output, used for optimized speed control of induction motors.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality.

B. The manufacturer of the variable frequency motor controller shall have a minimum of fifteen (15) years experience in the design, construction, and application of adjustable frequency controls for heating, ventilating and air conditioning applications.

C. All controllers, with factory mounted options, shall be UL (508C), ETL or CSA certified.

D. All drive manufacturers shall require local supplier representation within 50 miles of the job site, and a suitable service organization capable of repairing equipment within a 24 hour period of notification.

E. All drive manufacturers shall generally have a full line of locally stocked drives with similar features and in sizes consistent with those specified for emergency 24 hour replacement.

F. All VFD’s shall have a minimum mean time between failure ratings of no less than 150,000 hours.

1.4 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 23 05 00.

B. Clearly identify all options furnished including detailed wiring diagrams indicating required field connections and wiring to be provided under Division 26 and for Temperature Control System interface.

C. Submittal shall include a list of each specification section paragraph number and notation on each specific feature, function or method of operation in which compliance is intended. Lack of compliance with this requirement will be cause for rejection of submittals.

1.5 PRODUCT HANDLING

A. Storage, handling, and protection of materials shall be in accordance with Section 23 05 00. All drives shall be completely wrapped at the factory with a semi-dust tight enclosure, similar to a heat shrink

plastic, to prevent dust and debris from getting into the drive enclosure. Drives shall continue to be protected during construction in a similar fashion and be stored in a dry clean location.

B. The drive shall be wrapped with a low efficiency polyester media filter when power is supplied to the drive and when operated during the construction period. Filter shall be cleaned or replaced regularly to prevent overheating of the drive and electronics.

C. All materials or equipment damaged during transit, handling, or installation shall be replaced at no cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. The variable frequency controllers furnished shall convert 480, 240 or 208 volt (Refer to and verify from Plans and submittals), +10 to -5%, three-phase, 60 Hertz, + 3% utility power phase to phase imbalance to adjustable voltage and frequency, + 1%, three phase A-C power for stepless motor control from 10% to 110% of base speed under variable torque load.

B. All general options and modifications shall mount within the standard adjustable frequency motor controller enclosure unless otherwise specified or in an integrally mounted expansion module.

C. Variable frequency drive systems shall not cause any radio, television, computer, or other communication system interference within the building in which it is installed. All drives shall meet the requirements of Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, Part 15, Subpart J, Class A devices. All drives shall include EMI/RFI filters.

D. The service voltage distortion shall be limited to 5% peak to peak. All drives shall comply with interference and distortion requirements contained herein. If, after units are installed and distortion or interference is traced back to the VFD Units, equipment manufacturer shall install isolation transformers or input line reactors at no cost to the Owner to eliminate the objectionable interference. All PWM drives shall have a minimum 5% line impedance, via, a 5% input 3 phase A.C. line reactor, 5% DC bus reactor, or a 3% input 3 phase A.C. line reactor combined with a 3% DC bus reactor.

E. All drive systems shall be capable of installation in long term operation in a mechanical room environment with a temperature range of 32°F to 104°F, a humidity level of 0% up to 95% non-condensing relative humidity, and be rated for the altitude applicable to the job site.

F. Enclosures shall have a minimum NEMA 1 rated metal enclosure, unless indicated otherwise elsewhere herein.

G. VFD's shall be capable of withstanding the following conditions without failure or mechanical damage:

1. Being disconnected under full load.
2. Single phasing or phase failure on both Input and Output.
3. Loose wiring on load or line side main connections.
4. Shorting between terminals on the same terminal board.
5. Being disconnected and/or make disconnect on a coast down of equipment.
6. Be able to be energized, pick up a motor load, with a spinning fan wheel, as an example.

H. **Variable frequency drives shall be the pulse width modulated (PWM) type as manufactured by Yaskawa, ABB, Trane, or Danfoss. No other manufacturers will be considered.**

I. All drives shall be of the same manufacturer unless the drive is furnished integral with a factory made piece of equipment.

J. All motors connected to drives shall have individual dedicated drives, Two (2) or more motors shall not be controlled by one (1) drive unless specifically indicated by the equipment schedule.

2.2 VARIABLE FREQUENCY DRIVE FEATURES

A. Drives shall include as a minimum the following:

1. Converter, inverter, regulator with replaceable plug in circuit boards.
2. Hand-off-auto selector switch or buttons.
3. Manual speed (frequency) selection.
4. Independently tuned acceleration and deceleration ramps (0-600 seconds).
5. 6-66 Hz controlled speed range.
6. Annunciator for remote indication of fault conditions. Store up to the last 10 faults that have occurred in the drive control panel.
7. All protective circuits and features as recommended by the manufacturer.
8. Frequency meter mounted in the door or on the enclosure or displayed on control panel display.
9. Electronic 4-20ma input signal receiver, with transceiver as required to interface with the temperature control system, adjustable for direct or reverse acting. Provide internal drive limits to prevent drive from exceeding 60 Hertz or dropping below minimum drive speed when the input signal exceeds 20ma or drops below 4ma, respectively.
10. Output contactor (for positive motor disconnect).
11. Plug-in tester card and meter unless all trouble shooting can be accomplished via control panel display and keypad.
12. Recommended replacement modules per operations and maintenance manuals.
13. Non-resettable elapsed time meter to indicate run time of connected load/motor (not power on to drive).
14. Input line fuses, Class J.
15. Automatic shut-off for overload conditions.
16. Output thermal overloads (one in each phase).
17. 115 VAC Control Power transformer with fused primary where required for the external control circuit. Coordinate requirement with Section 23 09 00.
18. Field adjustable input signal offset bias control device.
19. Auxiliary contacts for connection to an Energy Management System. Provide up to 2 analog outputs, 3 digital inputs and 3 output relays. Refer to Section 23 09 00, Controls and Instrumentation.
20. Standardized communications interface card suitable for connection to the specified Energy Management System (EMS), an embedded Building Automation System protocol for network communications. Refer to Specification Section 23 09 00 for requirements. Provide BacNET IP communication protocol capability.
21. Electronic Ground Fault Protection shall be provided for all operating conditions to include initial power applied up to full speed and full load conditions.

B. **Provide manual constant speed bypass switch with magnetic across the line starter, to include overload relays, and disconnects to allow the motor to open across the line in the event of VFD shutdown and to allow for a maintenance or service person to safely repair/service the drive while the load is operated by the starter for pumps only. Provide drive output isolation contactors and bypass contactors to accomplish this function.** Provide time delay in switch-over circuitry to allow running motor to coast to stop when switched from drive to starter and vice versa. Additionally provide an integral input power supply disconnect on all drives. Bypass features shall include a control safety circuit terminal strip, 115 VAC control transformer, a Drive/Bypass selector switch, Hand-Off-Auto Switch, and indicating LED lights for BYPASS ON, Control Power ON and Drive RUNNING. **Either 3 contactor bypasses are acceptable or 2 contactor bypasses with service switch and fast acting fuses (NEC approved disconnect switch to service drive) will be allowed.**

C. Variable frequency drives shall be of the pulse width modulation type provided the minimum number of pulses per output cycle is at least 5000 at 30 hertz and below to minimize motor heat and noise

D. Provide auto restart package on each drive to restart the motor when power resumes after a power interruption. A minimum of five (5) attempts at restart shall occur before the drive goes into a fault condition.

E. Provide a minimum of three (3) critical speed coast troughs for all fan drives.

F. Provide bus capacitors, or equivalent feature, for minimum 500 millisecond power loss ride-through capabilities at a minimum of 50% load.

G. Provide components necessary for maintaining a high input power factor, with a minimum displacement angle of 0.95, over the entire range of operating speeds and loads.

H. Minimum drive efficiency shall be 95% at 50% speed and 97.5% at 100% speed conditions without exception.

I. Drives shall be rated to withstand 110% of full load amps of connected motor size for up to one (1) minute (60 seconds) and 150% of rated full load amps instantaneously.

J. VFD's and bypasses shall each have a minimum short circuit rating of 65K amps RMS where circuit breaker disconnects are employed and 100K amps RMS when drives employ fused disconnects, all without additional input fusing.

K. The starting torque shall be 100% available from 0.5 Hertz up to 60 Hertz output operating frequency.

L. Provide for DC injection braking to prevent fan "wind milling" at a start or stop command, adjustable, with current limited, on all drives serving fans.

M. All programming memory shall be saved when the VFD power source is disconnected. This shall require that all memory for the purpose be non-volatile memory (NV RAM).

N. Provide an automatic energy saving, reduced voltage operation, when the drive has been de-energized, no command to "run", for a pre-determined time frame, adjustable. This shall be the equivalent to a sleep mode function.

2.3 ELECTRONIC COMPONENTS QUALITY ASSURANCE

A. All printed circuit boards shall be tested under a temperature cycling (0°C to +65°C) load test and then functionally tested via fault finder bench equipment prior to unit installation.

B. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults and drive shall trip electronically without device failure.

C. Each VFD shall be put through a 30-minute cycling motor load test before inspection and shipping.

D. Certification that all of the testing above has been performed shall be provided by the drive manufacturer.

E. Conduct in circuit testing of all printed circuit boards to insure the proper mounting and the correct values for all electronic components.

F. Final printed circuit board assemblies shall be functionally tested, via computerized test equipment. All tests and acceptance criteria shall be pre-programmed. All test results shall be stored as detailed quality assurance data.

G. All fully assembled controls components shall be functionally tested, with fully loaded induction motors. The combined test data shall then be analyzed, to insure adherence to identified quality assurance specifications.

H. Inspect and perform a production test, under load, for each completed VFD assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The motors and drives approved shall be shipped to the job site as scheduled and installed under the supervision of a factory trained manufacturer's superintendent. The manufacturer shall furnish all control

and wiring diagrams for inclusion in the temperature control system shop drawings. The electrical wire, wiring and termination work shall be done under Division 26 for power wiring and Section 23 09 00 for temperature control wiring, coordinating all work with and under the supervision or instruction of the drive equipment manufacturer's representative.

B. A variable frequency controller shall be provided as indicated on the schedule for each AHU supply fan and for each individual pump as scheduled.

3.2 SERVICE

A. The manufacturer shall provide the following services performed by a factory authorized and fully trained representative only.

1. Factory coordinated start-up service.
2. Training of Owner's personnel in basic trouble-shooting.
3. Training shall be on site and shall be a minimum of four (4) hour duration and shall be performed in addition to start-up of system on a different day after completion of test and balance work.
4. Visit the facility two (2) times during the warranty period, once six (6) months after and once twelve (12) months after the warranty period to perform check-out and maintenance of drives, make any required adjustments and replace any components found to be defective. Report to the Owner in writing outlining work performed.

B. Furnish spare parts list.

C. Provide a three (3) year parts and labor warranty for all drives beginning at Substantial Completion. Warranty shall also include travel and lodging expenses for warranty repair personnel as required. All units shall be installed and checked out to be operating as recommended by the manufacturers authorized and factory trained start-up agent before warranty begins. This includes completion of a factory authorized representative start-up report. Submit completed start-up reports with close-out documents.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections, as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.2 SYSTEM DESCRIPTION

A. A complete system of vibration isolation for all mechanical equipment subject to the transmission of noise and vibration to the building.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality and have been manufactured by a firm with a minimum of five (5) years of experience in this field.

B. All equipment and materials shall be installed in a workmanlike manner by experienced mechanics and as recommended by the equipment and vibration isolation manufacturers.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions for all vibration isolation equipment.

B. Shop Drawings: Submit in accordance with Section 23 05 00.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall be rejected.

B. Storage and protection of materials shall be in accordance with Section 23 05 00.

C. Install materials and equipment at the proper time to keep pace with the general construction and the work of other trades involved so as not to delay the project completion schedule.

PART 2 - PRODUCTS

2.1 GENERAL

A. Objectionable vibration or noise created in any part of the building by the operation of any equipment furnished and/or installed under Division 23 will not be permissible.

B. Contractor shall take all precautions against the same by isolating the various items of equipment, pipes, and ducts from the building structure and by such other means as may be necessary to eliminate the transmission of excessive vibration and objectionable noise produced by any equipment installed thereby.

C. Design all foundations, supports, etc., for equipment, piping and ductwork with this end in view.

D. Contractor shall supervise and instruct the construction of all foundations and supports, in order that they may be constructed in such manner as to prevent the transmission of noise and vibration.

2.2 APPLICATIONS

A. Isolating material shall be selected in each case in accordance with the manufacturer's recommendations and the latter shall be prepared to demonstrate, upon request of the Architect, the isolation effectiveness of the material which has been installed upon his recommendation.

B. Isolators shall be so selected that when all the items in each of the mechanical rooms are in simultaneous operation, the vibration transmission to the building at the lowest disturbing frequency shall be limited to a maximum of 10% for a mechanical equipment room floor that is on the ground and 5% for all other building surfaces, including those in fan rooms, from all the equipment when the various items are in harmony.

C. Isolators for Fans suspended from the construction above on rod hangers, not internally isolated, shall be of the open spring type with housings and noise washers, lock washers, nuts, etc. Isolators shall be similar to Isolators shall be similar to Amber Booth type BSW-1 or 2 or KDXW-1 or 2 with a minimum 1 inch deflection for fans. For fans less than 1000 CFM in capacity they may be isolated with rubber-in-shear isolating grommets in lieu of spring isolators.

D. Transformers, or other equipment to be installed on housekeeping pads shall be mounted on ribbed neoprene pads equal to Amber Booth Ampad Type NR or NRC, Style B isolators.

E. Condensing units, curb mounted fans, rooftop air conditioning units or other equipment to be installed on roof curbs, use two inch (2") wide x 3/8" thick neoprene isolation strips to be in continuous contact at all curb to equipment contact areas..

2.3 MANUFACTURER

A. Isolating material used shall be equivalent to Amber-Booth, Peabody, Korfund Vibration Mountings, or Mason.

PART 3 - EXECUTION

3.1 PERFORMANCE OF ISOLATORS

A. Comply with recommendations set forth by the American Society of Heating, Refrigerating and Air Conditioning Engineers for the selection and application of vibration isolation materials and units.

B. Comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

C. Place isolators where indicated and where specified herein. Coordinate all isolator selections with approved equipment and other pertinent shop drawings of exact equipment to be isolated. Verify to ensure accuracy of load points and take into account any accessory devices adding to equipment loads to be supported by isolators.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC EQUIPMENT AND PIPING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections as applicable. Refer to other Divisions for coordination of work with other portions of the work.

1.2 SYSTEM DESCRIPTION

A. Provide a complete system of Piping Identification as specified herein for each of the systems as described herein.

B. Provide a complete system of valve identification by the use of tags as described herein.

C. Provide a complete system of equipment identification tags as described herein.

1.1 QUALITY ASSURANCE

A. The installation of all mechanical system identification devices shall be performed under this Section of the Specifications using materials which are the product of reputable manufacturers. The application of the materials shall be in strict accordance with the published standards of the manufacturer of the materials, using any special materials as required by these specifications and by those published standards.

B. Manufactured Piping Identification markers, equipment name plates shall be a product of Seton Name Plate Corporation, EMED Company, Inc., or Craftmark Identification to meet all ANSI Standards pertaining thereto.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions in accordance with Section 23 05 00.

B. Shop Drawings:

1. Submit a list of all piping, to be identified, color of background to be used, legend or wording to be displayed for each system, and the intended location of all markers to be displayed.
2. Submit a list of equipment to receive identification tags, cut sheets and proof copies of tags which indicate location of tag and wording to be engraved thereon.

1.3 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Storage and protection of materials shall be in accordance with Section 23 05 00.

PART 2 - PRODUCTS

2.1 PIPING IDENTIFICATION SYSTEM

A. Furnish piping identification markers for all insulated and uninsulated piping systems in sizes and colors in accordance with ANSI Standard A13.1. Markers shall be as manufactured by Seton Name Plate Corporation similar to their vinyl plastic "Setmark" pipe markers with flow arrows. For systems with overall outside diameters under 6" use the snap-around markers. For systems with overall diameters 6" and over use strap-around markers attached with nylon ties.

B. Markers shall be provided as a minimum for the following systems:

1. Drains (Green background), for all insulated drains not contained in one space or roof; i.e., an A/C condensate drain in a fan room shall not require identification, whereas, as drain extending to another space would.
2. Refrigerant Suction Piping (Yellow background).
3. Refrigerant Liquid Piping (Yellow background).

C. Refer to Section 09 90 00 for color code paint requirements for all exposed mechanical equipment and piping.

2.2 EQUIPMENT IDENTIFICATION

A. This Contractor shall provide identification plates similar and equal to Seton Name Plates, Style 15671(M4564).

B. Name plates shall be a minimum of 1/16" thick flexible multi-layered acrylic and be 1" X 3" in size with beveled edges. The surface shall be a black satin with a white core for lettering. Other color combinations may be used for specific systems where warranted. Each plate shall be drilled with two mounting holes sized for 3/8" No. 3 round head nickel plated steel screws. Lettering shall be a minimum of 3/16" high and lettering shall be cut through the black surface to the white core and be “Gothic Normal”. Only name plates equal to those specified will be considered. No punched plastic tape or engraved aluminum plates are acceptable. Stick-on only plates are not acceptable.

C. Provide and install identification plates on the cover of all starters or disconnects or combination starter-disconnects, where not mounted directly on the equipment, delivered by the mechanical system installer to the electrical systems installer and on each piece of Mechanical Equipment to include but not necessarily limited to:

1. Split Direct Expansion Indoor (Fan Coil) A/C Units.
2. Remote Air Cooled Condensing Units.
3. Exhaust/Ventilation Fans.
4. Unit Heaters (electric).
5. Roof Top Units.
6. Outside Air Intake Hoods.

D. Name plates shall have complete words describing equipment type, use and service. As an example, air handlers shall be designated "AHU-S-X MEP Shop" to designate the equipment as an air handler, number of air handler and area served. Use multiple or larger name plates as required to fulfill this requirement.

PART 3 - EXECUTION

3.1 PIPE MARKER INSTALLATION

A. Provide flow arrows at each marker location.

B. Markers shall be spaced not more than 30 feet on center and at each change of direction but not more than 4 feet in each direction from each elbow and tee.

C. Identification markers shall be installed on all new piping; and indoors.

D. Install markers on exposed piping systems only after jacketing systems and finish paint coats are complete. Refer to Sections 09 90 00 and 23 07 00.

3.2 IDENTIFICATION TAG INSTALLATION

A. Secure tags level and in a conspicuous location with adhesive on equipment starters or combination starter disconnects and on the equipment where starters are not immediately adjacent to the equipment served.

B. Additionally, secure all tags with screw fasteners after secured with adhesive.

END OF SECTION

SECTION 23 05 93

MECHANICAL SYSTEMS TESTING, ADJUSTING, AND BALANCING (TAB)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section shall be related to the General Provisions of the contract, including General and supplementary conditions.

B. Refer to Section 23 05 00 for general provisions.

1.2 SCOPE OF WORK

A. The mechanical Contractor will pay for any re-testing/re-commissioning required due to failure to comply with the contract document.

B. The work included in this Section consists of the furnishing of all labor, instruments, tools and services required in connection with the Testing, Adjusting and Balancing (TAB) of the Heating, Ventilating and Air Conditioning (HVAC) systems as described in the mechanical specifications and shown on the mechanical Drawings, or reasonably implied therefrom, to include the overall commissioning of systems and subsystems such as verification of operation of each control device and all equipment sequences of operation.

C. TAB of the HVAC systems will be performed by an impartial Technical Firm who is a member of the Associated Air Balance Council (AABC) and whose operations are limited only to the field of professional TAB work. TAB services shall be paid by allowance in general Contractor's scope. District shall select the TAB form at an early stage of the project and notify the Contractor if TAB firm that shall be employed.

D. TAB Firm is responsible to and shall submit all reports directly to the Architect/Engineer and as requested to the Owner.

E. TAB services shall result in the optimum temperature, humidity, airflow, pressurization, ventilation rates, and noise levels in the conditioned spaces of the building.

F. The following basic components of the HVAC systems shall be tested, adjusted and balanced:

1. Air distribution systems.
2. Air moving equipment.
3. Cooling systems.
4. Heating systems.
5. Domestic hot water recirculating pumps and related balance valves.
6. HVAC control systems verification to include end devices, control sequences of operation and energy management system control and monitoring point verification.

G. Document Review

1. The TAB Firm shall be responsible for reviewing the HVAC Drawings and specifications relating to the TAB services for proper arrangement and adequate provisions of devices for testing, adjusting and balancing.
2. TAB Firm shall review HVAC manufacturer's submittal data relative to suitable provisions to allow system to be balanced
3. TAB Firm shall review submitted HVAC automatic temperature control sequences for conformity to the specifications.

H. Three (3) hard bound copies and three (3) .PDF file copies saved onto USB drive of final report shall be submitted to the owner, or representative thereof, indicating a summary of actual operating data and any

abnormal operating conditions. The report will contain all required information as described within this specification. The files shall also include copies of HVAC drawings annotated to reflect tags used for air and water components balanced.

1.3 SERVICES OF CONTRACTOR

A. Contractor shall start up and test all materials and equipment which normally require testing. All piping, ductwork, etc., shall be tested to meet code requirements and the specification requirements, whichever is the more stringent. All equipment shall operate a sufficient length of time at the Contractor's expense to prove to the Architect, Engineer, and Owner that the equipment is free from mechanical defects, runs smoothly and quietly and performs satisfactorily to meet the requirements set forth in the Mechanical Drawings and Specifications.

B. In order that all HVAC systems can be properly tested, adjusted and balanced, the Contractor shall operate the HVAC systems at their expense for the length of time necessary to properly verify their completion and readiness for TAB, and shall further operate and pay all costs of operation during the TAB period if not otherwise specifically addressed to be paid by the Owner. Operating expenses to be paid for by the Contractor (not TAB firm) will include, where applicable, but not necessarily be limited to, the following:

1. Utility costs; electrical, water, gas, etc., as applicable.
2. Personnel costs to start, operate and stop all HVAC equipment.
3. All start-up labor and materials costs.
4. All maintenance costs.

C. The drawings and specifications have indicated valves, dampers and miscellaneous adjustment devices for the purpose of testing, adjusting and balancing the HVAC systems to obtain optimum operating conditions. It will be the responsibility of the Contractor to install these devices in a manner that will leave them fully accessible and readily adjustable to include access to allow recording of all motor and fan nameplate data. The TAB firm shall be consulted if there is a questionable arrangement of a control or adjustable device. Should any such device not be readily accessible, the Contractor shall provide access as required by the TAB firm.

D. Contractor shall provide and coordinate the services of qualified, responsible sub-contractors, suppliers, and personnel as required to correct, repair or replace any and all deficient items or conditions found before and during the TAB period.

E. As a part of this Project Contract, the Contractor shall make any changes in the sheaves, belts, motors, dampers and valves, or the addition of dampers and valves as required, to correctly balance the HVAC systems as required by the TAB firm at no additional cost.

F. Provide sufficient time in Project Contract completion schedule to permit the completion of TAB services prior to Owner occupancy of the project.

G. Contractor shall furnish, without charge to the TAB Firm, the following (Digital and Hard Copies):

1. One (1) complete set of project specifications to include all mechanical sections.
2. One (1) complete set of Contract Drawings.
3. All pertinent change orders and all Addenda.
4. Two (2) complete sets of mechanical plans with latest revisions.
5. Any "As-installed" and shop drawings.
6. Approved HVAC system control diagrams.
7. Approved manufacturer's submittals for all HVAC equipment to be included in the TAB scope of work.

H. Have all HVAC systems complete and in operational readiness prior to notifying the TAB Firm that the project is ready for TAB services. So certify in writing to the Architect, Engineer, and Owner that such a condition exists. Complete operational readiness prior to commencement of TAB Services shall include the following:

1. Construction status of building shall permit the closing of doors and windows, ceilings installed, etc., to permit the obtaining of projected actual operating conditions. Preliminary air testing may be conducted without ceiling tiles and completion of the facility. However, final air testing requires that ceilings be completely installed so that air pressurization relationships can be properly verified.
2. Air Distribution Systems:

    a. Verify installation for conformity to design of all supply, return and exhaust ducts.
    b. Verify that all volume dampers, smoke dampers and fire dampers are properly located, functional and open; verify that properly located, sized, and labeled access doors are installed in ducts and in general construction (ceilings, walls, furrings, etc.).

        1) Contractor shall manually release the fire, smoke or fire-smoke damper which shall be witnessed by the TAB firm or local municipality representative; to observe the full opening and closing of the dampers. Document these witness tests in writing.
        2) Contractor shall open or reset fusible links on these dampers, as required.
        3) Contractor shall furnish tags at each damper for recording the date, time and individual who last verified the operation of each damper.

    c. Verify that outside air, return air and relief air dampers provide tight closure, open fully and operate smoothly and freely.
    d. Verify that all supply, return, exhaust and transfer air diffusers, grilles and registers are installed as indicated on the mechanical Drawings.
    e. Verify that the correct size and type of terminal boxes are installed as indicated on the mechanical Drawings, and that they are fully operational.
    f. Verify that all built-up type air handling systems, air handling units, etc. and associated apparatus such as heating coils, cooling coils, filter sections, access doors, etc., have been blanked and sealed to eliminate the bypass of air around the coils, filters, etc. or leakage of air into or out of the unit.
    g. Install the specified type and quantity of clean filters at each air handling unit and maintain these filters for the complete period that the subject system is being tested, adjusted, and balanced. Refer to Section 23 30 00. New filters shall be installed just before air balance work is performed to insure clean filters are the basis of the test data provided.
    h. Verify that all (supply, return, relief and exhaust) fans are operational including proper fan rotation, operates free from vibrations, belts are properly aligned, and belt tension is proper.
    i. Verify that all motor starter overload heater elements are of proper size and rating; nameplate amperage to be within the range of the heater element size.
    j. Make a record of actual motor amperage and voltage, for each phase, and verify that they do not exceed nameplate ratings.
    k. Verify specified vibration isolation accessories are correctly installed and adjusted.
    l. Insure that all fan drive components, motors, belts, sheaves, and fan wheels are all accessible to allow for servicing and verification of name plate data, sizes, and model and serial numbers, as applicable.
    m. Provide additional air balance dampers, water balance valves, and replacement sheaves and belts as required to successfully complete TAB work.
    n. Flag all air balance dampers with flourescent, or other high visibility tape, leaving a minimum of one inch (1") wide by three inches (3") long exposed to view.

I. Automatic Controls:

1. Verify that all control components are installed in accordance with project requirements and are functional as intended by these specifications, including all electrical interlocks, damper sequences, air temperature resets, duct smoke detectors, high limit pressure sensors, safeties, etc.
2. Verify that all controlling instruments are calibrated and set for design operating conditions with the exception of room thermostats which shall be calibrated at the completion of TAB services in full cooperation between TAB Firm and controls system installer.
3. Automatic temperature control and/or energy management system installer shall thoroughly check all controls, sensors operators, sequences of operation, etc. before notifying the TAB agency that

the automatic temperature controls and energy management system are operational. Automatic temperature control and/or energy management system installer shall provide technical support staff (technicians and necessary hardware and software) to the TAB agency to allow for a complete check out of these systems; controls personnel to be on site with TAB firm as needed to assist the TAB firm in completing the TAB work.

4. The controls system installer shall also provide trending reports with the specific points and trend intervals, as requested by the TAB firm or engineer, when abnormal conditions are experienced.
5. The scope of the TAB work, as defined herein, is indicated in order that the contractor will be apprized of their responsibility regarding the coordination and assistance required to complete the project requirements for final TAB. The TAB Firm will be responsible to the Architect, Engineer, and Owner for the satisfactory execution of the TAB services.

1.4 SERVICES OF THE TAB FIRM

A. TAB Firm Qualifications:

1. TAB Firm shall be one which is organized to provide independent professional testing, adjusting and balancing services. The firm shall have one (1) Professional Engineer licensed in the State of Texas, with current registration, on their staff. TAB Firm shall have operated a minimum of ten (10) years, under its current firm name.
2. All personnel used on the job site shall be either TAB engineers or TAB technicians, who shall have been permanent, full-time employees of the Firm for a minimum of one (1) year prior to working on this specific project.
3. TAB Firm shall submit the following to the Architect/Engineer and/or Owner for approval prior to commencing services:

    a. Name and biographical data of the firms Professional Engineer and all other key personnel to be assigned to this project.
    b. Proof of company operation for a minimum of ten (10) years.
    c. Current AABC certification.
    d. Documentation of number of full time staff size, specifically those personnel who perform or supervise the performance of TAB work.

B. TAB Firm Responsibilities:

1. Liaison: The TAB personnel on the job shall act as liaison between the Architect, Engineer, Owner and Contractor.
2. Inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the HVAC systems during the early construction stages, and at other appropriate stages, for the purpose of reviewing that part of the work relating to proper arrangement and adequate provisions for TAB.
3. When performing inspection services prepare a punch list to be copied to the Architect, Engineer and Contractor noting observed deficiencies that would prevent adequate access to equipment and components installed or missing that would prevent the TAB Services from being carried out successfully.

C. TAB Firm Services:

1. TAB personnel shall, upon completion of the installation and start-up of the mechanical equipment systems, test, adjust and balance the HVAC systems to provide optimum temperature, airflow and noise conditions in the conditioned spaces in the building while the HVAC equipment is operating efficiently.
2. The Firm shall be responsible for testing, adjusting, balancing and logging actual data on all air distribution and air moving equipment, water distribution and water circulating equipment, fans, pumps, heating and cooling equipment and the operating conditions of all motors, etc. as indicated in this specification.

    a. Air Distribution Devices:

        1) Preset all volume dampers in the 100% open position.
        2) Determine and verify proper air pattern deflection devices have been installed.

3) Verify size and types of all air devices installed, versus, the sizes and types indicated on the Drawings, to include neck sizes of diffusers.
4) Read out all air distribution devices served by their source (VAV Terminal, FPB Terminal, Fan Coil Unit, Constant Volume Air Handling Unit, Supply Fan, Exhaust Fan, etc.)
5) Balance all air distribution devices proportional to design CFM.
6) Adjust source to design CFM.
7) Verify that all air distribution devices are balanced to within plus or minus 10% of design (and all proportional to one another, + 10% from high to low, on each system even if the total can not be within 10% of design).
8) Tolerances for 100% outside air ducts and outside air introduced through air handling equipment shall be +5% to -10%.

b. Supply/Exhaust/Ventilation Fans:

1) Verify correct fan rotation.
2) If belt driven, verify proper belt tension and that fan and motor sheaves are properly aligned.
3) Verify that all safeties and interlocks are operational.
4) Verify correct size and rating of motor overload protection.
5) Verify fan motor is not overloaded; amperage readings do not exceed nameplate rating, for each phase, as applicable.
6) Determine total air quantities of system served by the respective fan. Air quantities to be determined by duct traverse if duct configuration permits and air velocity is 800 to1000 feet per minute or greater. If the duct main is not suitable for traverse then traverse branch ducts as required to total air flows supplied by the system.
7) If air volume is less than design and motor capacity is available, adjust fan to design CFM. If new sheave or sheaves and belts are required, data will be submitted to Contractor.
8) Witness positive pressure duct leakage tests performed by the contractor on large exhaust systems to minimize duct leakage in these systems.
9) Balance air distribution system (see Air Distribution Devices).

c. Fire, Fire-Smoke, and Smoke Dampers:

1) Verify operation of all fire-smoke and smoke dampers only by witnessing the Contractor fully opening and closing these dampers.
2) Verify each fire, fire-smoke, and smoke damper is located where indicated on the Drawings and tagged or identified with a permanent fire resistant tag or stencil (at access door location).
3) Verify that each fire, fire-smoke, and smoke damper is provided with a suitably sized and located access door to allow full testing and observation of damper operation. Verify each duct access damper has suitable access through general construction features.
4) Witness the Contractor testing each fire-smoke and smoke damper which shall be manually released, allowed to fully close, verifying it has a tight fit when closed, and then verify it does not bind when opening or closing.
5) Witness each fire-smoke and smoke damper being fully opened by the Contractor and the fusible links on the fire damper portion of fire-smoke dampers being reset by the Contractor to include other related devices on smoke-fire dampers.
6) Verify that all fire dampers are fully opened.
7) Identify all dampers requiring repair or having a faulty installation.
8) Write down pertinent information on damper testing tags to verify dates tested and initials of tester to confirm a successful test was conducted.

d. Rooftop Air Conditioning Units (RTU):

1) Verify that the outside, return and relief air dampers are operational and move freely.
2) Verify that filters are new and clean at the time of testing.
3) Verify correct evaporator and return or relief air (as applicable) fan rotation.
4) If belt driven, verify proper belt tension and that fan and motor sheaves are properly aligned. If direct drive, verify that motor is a multi-speed motor and adjust speed setting for air balance purposes unless a single speed fan is used in conjunction with a variable frequency drive.
5) Verify that all equipment safeties are operational, as applicable, (low and high pressure limit switches, high static pressure, anti-recycle timer, etc.).
6) If applicable, verify that unit air volume control (static pressure) on VAV type units is operational. Set fan volume control device for 100% capacity (terminal boxes set at 100% capacity). Set point shall be slightly higher than the minimum pressure required to obtain design air flow at all terminals.
7) Verify correct size and rating of motor overload protection for each supply, return and relief fan motor.
8) Verify each fan motor above is not overloaded; amperage readings do not exceed motor nameplate rating.
9) Determine total supply and return air. Air quantities to be determined by duct traverse if duct configuration permits and air velocity is 800-1000 feet per minute or greater.
10) Balance air distribution system (see Air Distribution Devices).
11) If air volume is less than design and motor capacity is available, adjust fan or fans, to obtain supply and return design CFM quantities to within + 10% of design. If new sheave or sheaves and belts are required, data will be submitted to Contractor for change out. For direct drive fans, adjust fan speed setting. For fans served by variable frequency drives record fan speed and drive hertz at 100% design air flow. After adjustments are made, retest units to determine final air balance quantities.
12) If applicable, determine the required static pressure and submit the static pressure control set point to control contractor for setting. Final set point shall not be arbitrary, but shall be based on the minimum value to obtain design air flows at 100% operation.
13) Test and adjust the minimum outside air up to any maximum values scheduled, for demand controlled ventilation, and return air CFM relationship to design.
14) Verify all temperature control devices are set and calibrated at design set points. Document sensor values as compared to a calibrated temperature test instrument and further record Energy Management System offsets programmed to obtain calibration requirements specified herein.
15) Where air flow meters are installed verify flow rates through air flow measuring components.

e. Heat Exchangers, Cooling and Heating Coils:

1) Verify that all coils and heat exchangers are installed properly.
2) Verify that all cooling and heating coils have filters installed upstream of coils.
3) Verify no simultaneous cooling and heating occurs at any piece of equipment except during a humidity control sequence.
4) Verify correct overload devices are installed for electric heating devices.
5) Verify operation of all safety devices.
6) Record entering and leaving air dry bulb temperatures, as applicable, to determine actual air temperature drop or rise as compared to the design value for all equipment tested.

3. During the balancing process, all abnormalities or malfunctions of equipment or components discovered by the TAB personnel, will be reported promptly to the Architect, Engineer, Owner and Contractor so that the condition can be corrected expediently.

4. The temperature controls will be verified for calibration and proper relationship between control devices. The Contractor will be advised of any instruments out of calibration so that the Automatic Temperature Controls (ATC) contractor can recalibrate, using data supplied by the TAB Firm as required.
5. Thoroughly test the Energy Management System (EMS), as applicable. The testing of the Energy Management System shall include all HVAC controls, sensors, operators, sequences, etc. The tests shall include verification that commands introduced at the EMS console actually occur and temperatures, pressures, etc. indicated at the EMS console correlate with the actual reading at the sensing point. The ATC and EMS contractor shall provide technical support to the TAB Firm for a complete check out of the HVAC temperature controls and the Energy Management System. The EMS workstation console and field direct digital control panel displays of measured variables such as temperature, relative humidity, and pressure shall have the displayed values offset through software to be within 0.3 Deg. F. of the temperature, 5.0 percent for relative humidity 20 parts per million (PPM) for carbon dioxide, and 0.01% for pressure of the actual variables measured in the field, with recently calibrated test equipment, at the sensor locations.
6. After testing, adjusting and balancing to the design conditions, if comfort conditions are not being maintained, the air conditioning system shall be rebalanced within the limitations of the equipment installed to obtain comfort conditions. If comfort conditions cannot be obtained, a report will be submitted giving specific data regarding the trouble area.
7. Make not less than three (3) inspections within ninety (90) days after occupancy of the building, and make adjustments if required, to insure that satisfactory conditions are being maintained throughout. Inspections are to be coordinated with Architect, Engineer, and Owner; and shall be documented with a supplemental report containing data and information, as required, after each visit, to document in writing that such visit took place and to note any unusual operating conditions.
8. Make an inspection during the opposite season from that in which the initial adjustments were made and at that time make any necessary modifications to the initial adjustments required to produce optimum operation of the systemic components to produce the proper conditions in each conditioned space. The opposite season inspection shall be coordinated with the Architect/Engineer and Owner. This inspection shall be documented with a supplemental report containing any pertinent data and information regarding readings and adjustments made.

1.5 TAB REPORT

A. TAB report shall incorporate all performance data for the HVAC systems. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operating personnel.

B. All measurements and recorded readings (of air, electricity, etc.) that appear in the report must be made on site by the permanently employed technicians or engineers of the TAB Firm.

C. TAB report shall include but not be limited to the following:

1. Index.
2. Preface: A general discussion of the system, an outline of normal and ventilation modes of operation, any unusual operating conditions and any deficiencies not corrected as of the time the report was written.
3. Instrumentation List: A list of instruments used by type, model, range and calibration date. All instruments must be calibrated within six (6) months prior to the starting date of TAB services. Test probes used in domestic water system testing shall be sterilized before being used in these systems.
4. Air Distribution Devices (Supply, Exhaust, Return, and Relief Air type where Balance Dampers are Used):
    a. Manufacturer, model and size; include neck sizes for diffusers.
    b. Location (Room name and number, ceiling, wall, etc.).
    c. Design and actual CFM (cooling and heating).
    d. Air distribution devices, where a velocity indicating instrument is used to determine CFM; provide the required and actual velocity in FPM (when an air flow hood is used to determine CFM, only CFM is required to be recorded.)

5. Supply/Exhaust/Ventilation Fans:
    a. Manufacturer, model and size; include neck size where different than the designated device size.
    b. Location (Room name and number, above ceiling, roof mounted, etc.).
    c. Design and actual CFM.
    d. Design and actual fan RPM.
    e. Design and actual static pressure (leaving minus entering).
    f. Motor nameplate data.
    g. Motor starter data and motor overload protection (heater) sizes and rating.
    h. Actual motor amperage and voltage (all phases).
6. Fire, Fire-Smoke, and Smoke Dampers:
    a. Fill out a tag (provided by the Contractor) at each damper with a set of the tester's initials and the date that the damper was tested and operation verified, as witnessed by the TAB firm, as being acceptable.
    b. Tags shall have additional spaces for future testing/verification.
7. Cooling Coils and Heat Exchangers:
    a. Manufacturer, model, size and serial number where available.
    b. Design and actual CFM (to include purge CFM for Energy Wheels).
    c. Design and actual entering and leaving air static pressures.
    d. Design and actual entering air dry bulb temperatures. Provide design and actual entering air wet bulb temperatures for each cooling coil.
    e. Design and actual leaving air dry bulb temperatures. Provide design and actual leaving air wet bulb temperatures for each cooling coil.
    f. Actual outside air temperature, dry and wet bulb, during testing.
8. Split System Indoor Units:
    a. Manufacturer, Model, Size, and Serial Number.
    b. Design and actual CFM (supply, return, and outside air).
    c. Design and actual evaporator motor RPM.
    d. Static pressure entering and leaving filters, coils, furnaces, and fans.
    e. Evaporator motor name plate data.
    f. Evaporator motor starter data and motor overload protection size and rating, or setting, for adjustable devices.
    g. Actual evaporator motor amperage and voltage (all phases).
    h. Filters; type, thickness, sizes, quantities of each size, and condition (new, clean, dirty, loaded, wet, etc.).
9. Condensing Units:
    a. Manufacturer, Model, Size, and Serial Number.
    b. Location.
    c. Actual unit name plate data.
    d. Actual unit (compressor and condenser unit motors) amperage and voltage, all phases.
    e. Ambient air temperature entering condenser during indoor and outdoor unit testing.
10. Rooftop Air Conditioning Units:
    a. Manufacturer, model, size and serial number.
    b. Design and actual CFM (Supply, Return and Outside Air).
    c. Design and actual Evaporator Fan RPM.
    d. Static air pressure entering and leaving filters, coils and evaporator fan.
    e. Motor nameplate data.

f. Evaporator fan motor starter data and motor overload protection heater sizes and rating.
g. Actual motor amperage and voltage (all phases).
h. Filters; type, thickness, sizes, quantities of each size, actual static pressure drop across filters and condition (new, clean, dirty, loaded, etc.).

11. Electric Unit Heater:

a. Manufacturer and Model Number.
b. Heater sizes; design and actual Kw, BTUH to include number of stages.
c. Unit nameplate data versus actual, volts and amps per phase with heater fully energized, and per stage.
d. Fan motor nameplate data and actual volts and amps per phase and RPM.

D. Instructions to Operating Personnel: TAB Firm shall instruct the operating personnel regarding the following:

1. Systems Operation.
2. Unusual Operating Conditions
3. System Troubleshooting Procedures.

E. Guarantee: Provide extended warranty of twelve (12) months after occupancy during which time the Architect/Engineer and/or Owner may, at his discretion, request check of the balance of any HVAC equipment. Provide TAB technicians to assist as required in making such tests. When any device is found not balanced in accordance with the mechanical plans and specifications, that HVAC system shall be completely rebalanced as directed by the Architect/Engineer and/or Owner at the TAB Firm's expense.

END OF SECTION

SECTION 23 07 00

INSULATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.2 SYSTEM DESCRIPTION

A. Provide the systems of insulation which are specified for the control of heat transfer, sound control, and prevention of condensation.

B. Provide protective devices to prevent compression abrasion or puncture of the piping insulation systems installed to include inserts, pipe shields, PVC jacketing and aluminum jacketing as specified herein.

C. Provide piping identification systems as specified in Section 23 05 53, Mechanical Systems Identification for HVAC ductwork, equipment and piping.

1.3 QUALITY ASSURANCE

A. The installation of all thermal insulation shall be performed by a single firm regularly engaged in the insulation business, using skilled insulation mechanics and using insulation materials which are the product of reputable manufacturers. The application of the materials by the insulator shall be in accordance with the published standards of the manufacturer of the materials, using any special materials as required by these specifications and by those published standards.

B. Materials shall be manufactured by Schuller, Pittsburg Plate Glass, Owens-Corning, Foster, Childers, Certainteed, Johns Manville, or Knauf.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions to allow review of Materials and Methods to ensure complete compliance with specifications.

B. Shop Drawings: Submit materials to be used and method of application for each system in tabular form. General statements not specifically identifying means or methods to be used shall be cause for rejection. Include descriptive data and cut sheets on each type of insulation material, sealing method, adhesives used, insert types, shield sizes, and PVC or aluminum jacketing as specified.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Promptly replace all damaged, deteriorated or wet insulation materials.

C. Storage and protection of materials shall be in accordance with Section 23 05 00.

PART 2 - PRODUCTS

2.1 PIPING AND EQUIPMENT INSULATION MATERIALS

A. Interior Domestic Cold Water Lines: Refer to Division 22.

B. Domestic Hot Water and Hot Water Return Lines: Refer to Division 22.

C. Waste, Storm Drain, Condensate Drains, Drains and Miscellaneous Lines:

1. The drain from each piece of Air Handling Equipment condensate drain pan and all refrigerant suction piping shall be insulated with foamed plastic, Armacell Armaflex or Aeroflex Aerocell slipped on while the piping is being fabricated, and with all joints, butt type, sealed using an adhesive recommended by the manufacturer of the plastic. The insulation shall be continuous from the drain opening in the Air Handling equipment condensate pan to the point of discharge with an open sight air gap over a drain. All formed plastic insulation shall meet ASTM E-84 requirements. Provide 1/2" thick insulation on condensate drains and 1-1/2" thick insulation on refrigerant suction piping. For all “Armaflex” type insulation installed outdoors apply two (2) coats of NOMACO K-Flex R-374, or Foster 30-64, or approved equal, protective coating (ultra-violet rays), white in color.
2. The body of each floor drain, where the body of the drain is out of the ground, or above a ceiling shall be insulated: Refer to Division 22.
3. Waste lines serving electric water coolers and floor drains (includes P-traps) receiving cold condensate from air handling equipment condensate pans to the point where they join the nearest vertical waste stack or sanitary main: Refer to Division 22.
4. The body of all primary and overflow roof drain bodies shall be insulated: Refer to Division 22.
5. All horizontal and vertical primary storm drainage piping to the point of penetration to the underfloor and all of the overflow drain pipe from the drain body, horizontally and then down to include the first three feet (3’-0”) of the vertical section of overflow drain piping below the horizontal section: Refer to Division 22.

2.2 DUCTWORK INSULATION MATERIALS

A. Duct Insulation - External:

1. Concealed (above ceilings) external duct insulation shall be glass fiber blanket-type insulation of not less than 1 lb. per cu. ft. density with a factory applied flame-retardant vapor barrier facing. Facing shall consist of a layer of aluminum foil, reinforced layer of glass fibers, and a layer of kraft paper all bonded together with fire-retardant and adhesive. Insulation, adhesives, and tapes shall be rated in accordance with U.L. 181A or 181B. Minimum ductwrap insulation thickness shall be two inches (2") thick and be equal to Certainteed Type IV duct wrap.
2. All insulation systems shall meet the requirements of the most recent version of the International Energy Conservation Code, which requires a minimum installed R-value of 5.0 for conditioned, cooled or heated, and outside air system ductwork and plenums when located inside buildings or spaces. Increase insulation thicknesses as required to comply.
3. Water Vapor Permeance shall be no greater than 0.05 Perms per ASTM-E-96.
4. Fire Hazard Classification of installed duct insulation systems shall meet the requirements of ASTM-E-84; Flame Spread of 25, or less; Smoke Developed and Fuel Contributed of 50, or less. All insulation systems, adhesives, mastics, sealants, and tapes shall be U.L. rated for the application. All tapes used shall be acrylic based.
5. All external duct insulation shall be a regularly manufactured product of one of the following:

a. Knauf.
b. Owens Corning.
c. Johns Manville.
d. Certainteed.
e. Manson.

B. Duct Insulation - Internal:

1. Internal duct insulation, liner, shall be in thicknesses as indicated herein, and be as specified in Specification Section 23 30 00. Duct liner shall be one inch (1") thick on all return, transfer, and relief air ducts, and on portions of general exhaust air ductwork systems as specified elsewhere

herein. Internal duct insulation on all conditioned, cooled or heated, supply, all outside air ductwork systems and all mixed air plenums shall be 1-1/2" thick duct liner.

2. All duct liner shall be made of glass fiber coated with a bonded mat on the air stream side of the insulation. Coating shall be neoprene based meeting the requirements of NFPA-90A and U.L. Standard 723. Insulation shall not be less than 1.5 lbs. per cu. ft. density, and have a K-value of 0.28 per ASTM-C-177 at a mean temperature of 75 Deg. F.
3. All insulation systems shall meet the requirements of the most recent version of the International Energy Conservation Code, which requires a minimum installed R-value of 5.0 for conditioned, cooled or heated, supply and all outside air system ductwork and mixed air plenums when located inside buildings or spaces. Increase insulation thickness as required to comply.
4. Fire Hazard Classification of installed duct insulation systems shall meet the requirements of ASTM-E-84; Flame Spread of 25, or less; Smoke Developed and Fuel Contributed of 50, or less.
5. All insulation systems, adhesives, mastics, sealants, and tapes shall be U.L. rated for the application.
6. All duct liner shall be suitable for the air velocities to be encountered in each system, and shall generally be suitable for velocities of up to 6000 FPM.
7. Acceptable duct lining manufacturers shall be:

    a. Certainteed.
    b. Knauf.
    c. Owens Corning.
    d. Johns Manville.
    e. Manson.

C. One (1) Hour Fire Rated Shaft Alternative for Dryer Exhaust Systems: Flexible Wrap Systems used on dryer exhaust systems shall be listed and labeled by an NRTL, Nationally Recognized Testing Laboratory. Labeling on scrim shall include product name and certification mark. Wrap system shall be fully encapsulated to resist moisture absorption. Wrap system shall be tested per ISO 6944, Type A duct, and achieve a one (1) hour rating for Stability, Integrity, and Insulation. Wrap shall also be tested per ASTM E 119, ASTM E 814/UL 1479, and ASTM E-84 or UL/ULC 723. A listed and labeled firestop system shall be available to seal the opening where the protected duct penetrates a fire rated floor or wall. The wrap system shall be installed with steel tie wire and/or banding per manufacturer’s instructions. System is subject to approval of the local Authority Having Jurisdiction (AHJ) with the wrap material being Unifrax FyreWrap® DPS or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply insulation and pipe covering after all of the piping system to be insulated has been pressure tested, found to be completely tight (without leaks), and accepted as such.

B. On glass fiber pipe covering with factory applied vapor barrier jacket, lap the jacket on the longitudinal seams and seal with vapor barrier lap adhesive equivalent to Foster 85-20 or Childers CP-82. Tightly butt the ends and cover butt joints with a 4" wide band of vapor barrier jacket secured with the same adhesive. On piping systems with contents below ambient temperature, coat all taped ASJ butt and longitudinal seams with vapor barrier coating to prevent moisture ingress.

C. Where jacketing systems are specified, use standard weight, PVC sheet rolls. Exercise care to locate seams in an inconspicuous place and apply all jacketing neatly, including that on valves and fittings. Unsightly work will be considered a justifiable basis for rejection. Adhere the jacketing in all cases with a lagging adhesive, Foster 30-36 AF (Anti-Fungal) or Childers CP-137 AF, or by other approved methods. Adhesives shall have mold and mildew inhibitors. Lagging adhesives shall meet ASTM D 5590 with a “0" growth rating.

D. All insulation shall be continuous through wall and ceiling openings and sleeves. Use exterior duct wrap insulation on the outside of smoke and fire damper sleeves. Create a secondary sleeve around the primary sleeve to allow a complete insulation system as allowed by the local authority having jurisdiction.

E. All insulation and accessories shall have composite (insulation, jacket and adhesive used to adhere the jacket to the insulation) fire and smoke hazard ratings as tested under procedure ASTM E-84, NFPA 255, and UL 723 not exceeding:

Flame Spread	25
Smoke Developed	50
Fuel Contributed	50

F. Unsightly work shall be cause for rejection, including poor application of adhesives and coatings beyond the insulation which coats valves or other piping specialties.

G. Damage or Modification to Insulation: Where new insulation is disturbed or damaged during the process of installing other new materials, making new connections, etc., it shall be repaired or replaced to return it to its original condition and appearance. Where lines are removed and connections to insulated lines are capped, insulate those caps as well as repairing damaged insulation. Materials shall match those presently installed in thickness, density, insulating value, jacketing, etc.

H. Miscellaneous Lines: Piping connected to chilled or hot water lines through which there might be fluid flow on occasions such as the lines connected to air vents, lines running to compression tanks, etc. shall be insulated as described for other piping in those systems.

I. Hanger and Support Locations: At the location of hangers or supports for pipes run above ground and finished with a vapor seal insulation, provide rigid sections of cork, Foamglas, calcium silicate or high density polyurethane, at least the same thickness as the adjacent insulating material to adequately support the pipe without compression of the insulating material and cover with a vapor seal that is bonded to the adjacent insulation as described for fittings in the lines. Where the insert has an insulating value less than the adjacent pipe insulation the thickness of the insert shall be increased to equal the insulating value of the adjacent pipe insulation. Wood inserts shall not be allowed. Hangers and supports for piping insulation to receive a vapor barrier shall be installed exterior to the insulation.

J. Material Changes: Wherever there is a change in materials on lines that are vapor sealed, apply a suitable vapor barrier that is compatible with both materials, tapes, etc., as required to maintain the vapor barrier.

K. The following describes materials, thickness and finishes for insulation on piping. In the following "exposed" shall mean any line or duct exposed below the finished ceiling and structure where no ceiling is installed, in any room space, area, mechanical rooms, closets, and any line or duct run exterior to the building, including above the roof. "Concealed" shall mean any line or duct located above ceilings, in furrings, in chases, in crawl spaces, and buried in direct contact with the soil.

L. In all "exposed" areas, up to 12'-0" above the finished floor, insulation shall receive a PVC jacketing system. Neatly install all insulation systems not receiving jacketing such that they are suitable for finish painting.

M. All insulation materials and jacketing shall exhibit the following characteristics:

1. Water sorption, per ASTM C 1104, shall be less than 0.02%.
2. Linear shrinkage, per ASTM C 356, shall be negligible.
3. Stress corrosion, per ASTM C 795, shall not cause corrosion.
4. Corrosiveness, per ASTM C 665, shall not be any greater than sterile cotton.
5. Resistance to fungi, mold and mildew and bacteria, per ASTM C 665, shall be rated as not promoting growth of fungi and bacteria. Inhibitors shall be added to specified products to meet these requirements.

3.2 DUCTWORK

A. Duct Insulation - Internal: Provide sound absorbing and thermal insulation to the interior surface of the following duct systems: All rectangular low pressure supply, return, relief, transfer, and outside air ducts

and supply, mixed, and return air plenums. Additionally, line the first 10 feet of general exhaust ducts, except fume, and other industrial exhaust systems, on both sides of in-line fans and for the first 10'-0" from the fan curb toward the occupied space for roof mounted fans. All lined ductwork shall be increased in size to maintain the clear inside (air stream) dimensions designated on the Drawings.

1. Duct liner shall be applied in accordance with the manufacturer's recommendations, with the coated, or mat-faced, surface located away from the metal (exposed to air stream). It shall be adhered to the metal with Foster 85-60 or Childers CP-127 adhesive applied to the entire inner surface of the duct. The liner shall be further secured to the duct with Graham Insulating Pins and Clips or other metal clips of the type which do not protrude through the duct. Those clips shall be installed on not greater than 12" centers both ways. All seams and openings in the liner shall be carefully sealed with adhesive.
2. Paint all joints in liner and butter the edges of sections where sections of ductwork will be joined using Foster No. 30-36 or Childers CP-137, or equivalent approved adhesive. Alternately, use a black “duct butter” which shall be Childers CP-135-2.
3. Where damper rods occur, suitable metal bushings shall be provided on each end of the damper rod inside the duct, to provide clearance between the damper blade and the lining.
4. Refer to Section 23 30 00 as applicable, Air Distribution Duct Systems.
5. Due to the most recent version of the International Energy Conservation Code, conditioned air, heated or cooled air (includes outside air intake ductwork), ductwork insulation located inside the building envelope shall have a minimum installed R-value of 6.0. For lined ductwork, this shall be accomplished by using 1-1/2" thick duct liner. Coordinate insulation requirements with other Sections of these Specifications.

B. Duct Insulation - External:

1. Externally insulate all rectangular and round supply and return air ducts not containing internal lining.
2. Additionally insulate the outside of all fire, fire-smoke, and smoke damper sleeves penetrating walls and floors to insure a continuous insulation system.
3. External insulation shall be applied in accordance with the manufacturer's recommendations by impaling over pins using speed clips or be secured with adhesive.
4. Seal all joints, breaks, fastener penetrations and punctures with a 3" wide vapor barrier strip similar to that of facing materials secured with adhesive. Pins shall be spaced 12" on center both ways. Adhesive shall cover the entire duct surface.
5. Blanket type insulation shall generally be used on concealed ductwork only with rigid insulation board being used exclusively on exposed ductwork, which shall also receive a PVC jacket when located 12'-0", or less, above the finished floor.
6. Vapor Seal all jacketing penetrations, cut openings, and cut edges and taped seams with an approved vapor barrier coating, Foster 30/33 or Childers CP-33 vapor barrier coating. All vapor barrier coatings shall have a maximum permeance rating of 0.07 or less at 45 mils dry per ASTM-E-96, procedure B.

3.3 SHIELDS AND INSERTS

A. Metal saddles, shields, shall be applied between hangers or supports and the pipe insulation. Saddles shall be formed to fit the insulation and shall extend up to the centerline of the pipe and the length specified for hanger inserts. Shields shall be made of galvanized sheet metal and shall be of sufficient size and length to prohibit the crushing of the insulation materials. Saddle shields shall be as follows:

Pipe Size	Metal Saddles	
	Metal Gauge	Length
3/4" to 3"	18	12"
4" to 6"	16	12" - 18"
8" to 10"	14	24"
12" & Larger	12	24"

B. Provide inserts of calcium silicate on hot piping and cellular glass or 7#/Cu. Ft. fiber glass pipe insulation on cold piping at hangers except pipes 1-1/2" or smaller in size. Inserts between the pipe and pipe hangers shall consist of rigid pipe insulation of a thickness equal to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall not be less than the following lengths:

Pipe Size	Insert Length
3/4" to 3"	12"
4" to 6"	12" - 18"
8" to 10"	24"
12" & Larger	24"

END OF SECTION

SECTION 23 08 00

MECHANICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections, as applicable. Refer to other divisions for coordination of work with other portions of Work.

1.2 DESCRIPTION

A. The mechanical Contractor will pay for any re-testing/re-commissioning required due to failure to comply with the contract documents.

B. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that Systems and Operations and Maintenance (O&M) documentation is complete.
4. Verify that the Owner's operating personnel are adequately trained in the O&M of these systems.

C. The systems to be commissioned include: packaged single zone Roof-Top AC Units, Split DX AC Units, Exhaust Fans, Electric Unit Heaters, life safety systems and all related controls.

D. Commissioning requires the participation of Division 23 and 26 system installers to ensure that all systems are operating in a manner consistent with the Contract Documents. Division 23 installers shall be familiar with all parts of the commissioning plan issued by the Commissioning Authority (C.A.) and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

E. Commissioning Team members shall consist of the Commissioning Authority (C.A.), the designated representative of the Owner, the General Contractor (GC, CM or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the Testing, Adjusting, and Balancing (TAB) representative, the Controls Contractor (CC), and any other installing subcontractors or suppliers of equipment pertinent to the complete installation of Division 23 and 26 Systems intended to be Commissioned. The Owner's building or plant operator is also a member of the commissioning team.

F. Commissioning will be performed by an impartial independent Technical Firm who is a member of the Associated Air Balance Council (AABC) and whose operations are limited only to the field of professional TAB work. The firm selected shall not be engaged in any contracting, manufacturing or engineering services. Owner shall select commissioning firm at an early stage of the project and notify the Contractor the TAB Firm that shall be employed.

1.3 COMMISSIONING AUTHORITY

A. The commissioning authority or agency shall be selected and employed by the building owner. The commissioning agent shall be a licensed professional engineer in the State where the work will be performed, and shall be experienced in the commissioning of mechanical and electrical systems of the

type installed in this project. Experience in the construction process, direct digital control systems, Testing, Adjusting, and Balancing; and ASHRAE Guideline 1.1-2007 is mandatory. The commissioning agent shall not be associated with or employed by a mechanical contractor, or equipment supplier. Contractor shall include the allowance indicated in Division 1 Section 01 20 00 of the specifications for the commissioning services. **Commissioning Services shall be paid by an allowance in general contracting scope**. CMR shall select the commissioning authority at an early stage of the project and notify the Contractor of the C.A. that shall be employed.

1.4 COMMISSIONING PLAN

A. Commissioning Plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will provide the plan, which will continue to evolve and expand as the project progresses. The project Specifications shall take precedence over the Commissioning Plan.

B. Commissioning Process includes a narrative that provides a brief overview of the typical commissioning tasks during construction and the general order in which they will occur.

1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
2. Additional meetings will be required throughout the active construction phase, as scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
4. The CA works with the pertinent subcontractors in developing startup plans and startup documentation formats, including pre-functional checklists to be completed, during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.
6. The Subcontractors, under their own direction, execute and document the pre-functional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.
7. The Subcontractors develop proposed specific equipment and system functional performance test (FPT) procedures. The CA will review these procedures and develop the official FPT procedures to be incorporated into the project.
8. The procedures are executed by the Subcontractors, under the direction of, and documented by the CA.
9. Items of non-compliance in material, installation or setup are corrected at the Subcontractor’s expense and the system is then retested.
10. The CA reviews the O&M documentation for completeness.
11. Commissioning is intended to be completed before Substantial Completion.
12. The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that it was completed.
13. Deferred testing is conducted, as specified or as required.

1.5 RESPONSIBILITIES

A. General Contractor (GC):

1. Facilitate the coordination of the commissioning work as outlined by the CA, and with the assistance of the CA, ensure that all commissioning activities are being scheduled into the master construction schedule.
2. Include all costs of commissioning, as outlined herein and elsewhere, in the total contract price.

3. Furnish one (1) copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to equipment to be commissioned to the CA.

4. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and complete training.
5. Ensure that all subcontractors execute their commissioning responsibilities according to the Contract Documents and schedule.
6. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Commissioning process.
7. Coordinate the training to be provided to the Owner's personnel.
8. Prepare O&M manuals and systems manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to "as-built" conditions.
9. Warranty Period:
10. Ensure that Subcontractors execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
11. Ensure that Subcontractors correct deficiencies and make necessary adjustments to O&M manuals and "as-built" drawings for applicable issues identified in any seasonal testing.

B. Mechanical and Controls Systems Installers:

1. Commissioning responsibilities applicable to each of the mechanical and controls (systems installers) of Division 23 are as follows (all references apply to commissioned equipment only):

    a. Construction and Acceptance Phases:

        1) Include the cost of commissioning in the contract price.
        2) In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, Systems and O&M data and training.
        3) Attend a commissioning scoping meeting and other meetings necessary to facilitate the Commissioning process.
        4) Contractors shall provide the CA with normal cut sheets and shop drawing submittals of all equipment to be commissioned.
        5) Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.

            a) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
            b) The Commissioning Agent may request further documentation necessary for the commissioning process.
        6) Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
        7) Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
        8) Preparing proposed specific functional performance test procedures for submission to and consideration of the CA. The CA will use these submittals to prepare finalized test procedures. Subcontractors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests, as applicable.
        9) Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup.
        10) During the startup and initial checkout process, execute the mechanical-related portions of the pre-functional checklists for all commissioned equipment.

11) Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
12) Address current A/E punch list items before functional testing. Air TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air related systems.
13) Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
14) Perform functional performance testing under the direction of the CA for specified equipment. Assist the CA in interpreting the monitoring data, as necessary.
15) Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, and A/E and retest the equipment.
16) Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to “as-built” conditions.
17) Prepare redline “as-built” drawings for all drawings and final “as-builts” for contractor-generated coordination drawings.
18) Provide training of the Owner’s operating personnel as specified.
19) Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

b. Warranty Period:

1) Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
2) Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

C. Mechanical (Systems Installer) Contractor:

1. The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:

a. Provide startup for all HVAC equipment, except for the building automation control system.
b. Assist and cooperate with the TAB contractor and CA by:

1) Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
2) Including cost of sheaves and belts that may be required by TAB.
3) Providing temperature and pressure taps in piping and equipment according to the Construction Documents for TAB and commissioning testing. Verify locations for taps with the CA before installation.

c. Prepare a schedule for Division 23 equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.
d. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

D. Controls (Systems Installer) Contractor (CC):

1. The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:

1) Sequences of Operation Submittals. The Controls Contractor’s submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

2) An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.
3) All interactions and interlocks with other systems.
4) Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
5) Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).
6) Start-up sequences.
7) Warm-up mode sequences.
8) Normal operating mode sequences.
9) Unoccupied mode sequences.
10) Shutdown sequences.
11) Capacity control sequences and equipment staging.
12) Temperature and pressure control: setbacks, setups, resets, etc.
13) Detailed sequences for all control strategies, e.g., optimum start/stop, staging, optimization, demand limiting, etc.
14) Effects of power or equipment failure with all standby component functions.
15) Sequences for all alarms and emergency shut downs.
16) Seasonal operational differences and recommendations.
17) Initial and recommended values for all adjustable settings, set points and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
18) All sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

b. Control Drawings Submittals shall include:

1) Control drawings shall have a key to all abbreviations.
2) Control drawings shall contain graphic schematic depictions of each system and each component.
3) Schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4) Provide a full points list with at least the following included for each point:

a) Controlled system.
b) Point abbreviation.
c) Point description.
d) Display unit.
e) Control point or set point (Yes / No).
f) Monitoring point (Yes / No).
g) Intermediate point (Yes / No).
h) Calculated point (Yes / No).
i) Key:

(1) Point Description: DB temp, airflow, etc.
(2) Control or Set point: Point that controls equipment and can have its set point changed (OSA, SAT, etc.)
(3) Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).

(4) Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
(5) Calculated Point: “Virtual” point generated from calculations of other point values.

5) Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

c. An updated “as-built” version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

d. Assist and cooperate with the TAB contractor in the following manner:

1) Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
2) Have all required pre-functional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.
3) Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

e. Assist and cooperate with the CA in the following manner:

1) Execute the functional testing of the controls system as specified for the controls contractor.
2) Assist in the functional testing of all equipment specified.

f. Controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:

1) System name.
2) List of devices.
3) Step-by-step procedures for testing each controller after installation, including:

a) Process of verifying proper hardware and wiring installation.
b) Process of downloading programs to local controllers and verifying that they are addressed correctly.
c) Process of performing operational checks of each controlled component.
d) Plan and process for calibrating valve and damper actuators and all sensors.
e) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4) A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5) A description of the instrumentation required for testing.
6) Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.

g. Provide a signed and dated certification to the CA and CM or GC upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

h. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified.
i. List and clearly identify on the “as-built” duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

E. TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:

1. Submit the outline of the TAB plan and approach for each system and component to the CA prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.
2. Submitted plan will include:

a. Reviewed the construction documents and the systems to sufficiently understand the design intent for each system.
b. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
c. Detailed step-by-step procedures for TAB work for each system and issue.
d. Plan for formal deficiency reports (scope, frequency and distribution) and final report.

3. Submit reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA as required.
4. Communicate to the controls contractor all set point and parameter changes made or problems and discrepancies identified during TAB, which affect the control system setup and operation.
5. Provide a draft TAB report to the CA. The report should follow the latest reporting recommendations by AABC.
6. Provide the CA with any requested data, gathered, but not shown on the draft reports.
7. Provide final TAB reports in the number required.

F. Equipment Suppliers:

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.
4. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.

G. Commissioning Agent (CA):

1. The CA is <u>not</u> responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance items or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance so that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. Contractor and all subcontractors shall provide all tools or the use of tools to start, checkout and functionally test equipment and systems, to include any specified or required testing equipment needed to conduct these tests.
2. Construction Phase:

a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
b. Coordinate the commissioning work and, with the GC, ensure that commissioning activities are being scheduled into the master schedule.
c. Revise, as necessary, Commissioning Plan - Construction Phase.
d. Plan and conduct a commissioning scoping meeting.

e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
f. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
g. Review normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, along with A/E reviews.
h. Assist in the development of pre-functional tests and checklists.
i. Assist in the development of an enhanced start-up and initial systems checkout plan with Subcontractors.
j. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
k. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
l. Witness all or part of any ductwork testing and cleaning procedures, if required, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
m. Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot-checking.
n. Approve systems startup by reviewing start-up reports and by selected site observation.
o. With necessary assistance and review from installing contractors, review the functional performance test procedures for equipment and systems. This may include energy management control system trending, or manual functional testing.
p. Analyze any functional performance trend logs and monitoring data to verify performance.
q. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
r. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
s. Oversee and approve the training of the Owner's operating personnel.
t. Compile and maintain a commissioning record and building systems book(s).
u. Review and approve the preparation of the O&M and Systems manuals.
v. Provide a final commissioning report.

3. Warranty Period:

a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
b. Return to the site at 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

1.6 SCHEDULING

A. The CA will work with the GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities.

B. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the applicable Division 23 or 26 contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by the TAB firm in their commissioning responsibilities.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the Base Bid price of the Contractor and be left on site.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of + or - 0.5°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed to the test equipment or certificates of calibration shall be readily available with a copy being furnished to the C.A. for their records.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting. Within 90 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the GC. Information gathered from this meeting will allow the CA to revise the Commissioning Plan to its "final" version, which will also be distributed to all parties.

B. Miscellaneous Meetings will be planned and conducted by the CA as required as the construction phase progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subcontractors. The CA will plan these meetings and will minimize unnecessary time being spent by Subcontractors, or any other member of the Commissioning Team.

3.2 REPORTING

A. CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

B. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

C. A final summary report by the CA will be provided focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Pre-functional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

3.3 SUBMITTALS

A. CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal

submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.

B. Commissioning Agent will be given the opportunity to review all pertinent submittals related to equipment or systems to be commissioned for conformance to the Contract Documents, and more specifically as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning Agent will notify the appropriate persons as requested, of items missing or areas that are not in conformance with Contract Documents as it relates to the commissioning process, and which require resubmission.

C. CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. Submittals sent to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, although the CA will review them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery may have very simplified PCs and startup.

B. Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plans will be required by the CA who shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for pre-functional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements.

1. Checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.
2. Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form may have more than one trade responsible for its execution.
3. Each Subcontractor responsible for the purchase of each item of equipment shall develop the full start-up plan for that equipment by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:

    a. Pre-functional checklists developed jointly by the CA and the subcontractors.
    b. Manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
    c. Manufacturer's normally used field checkout sheets.

4. Each Subcontractor shall submit the full startup plan for which they are responsible to the CA for review and approval.
5. CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
6. Full start-up procedures and the approval form may be provided to the CM for review and approval, depending on management protocol.

D. Sensor Calibration of all sensors shall be included as part of the pre-functional checklists performed by the Contractors, according to the following procedures:

1. Sensors without Transmitters, Standard Application type, shall include taking readings with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Sensor	Required Tolerance (+/-)		Sensor	Required Tolerance (+/-)
RTU wet bulb or dew point	1.0 Deg. F.		Flow rates, air	10%of design
Indoor and outdoor air pressure differential	0.05 Inches W.G.		Pressures, air	5% of design
Outside air, space air, coil air temps	1.0 Deg. F.		Watt-hour, voltage & amperage	2%

E. Execution of Pre-functional Checklists and Startup.

1. Four weeks prior to startup, the Subcontractors and pertinent vendors shall schedule startup and checkout with the GC and CA. The performance of the pre-functional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off pre-functional checklists, signatures may be required of other Subs for verification of completion of their work.
2. CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved).
3. For lower-level components of equipment, (e.g., fans, sensors, controllers), the CA shall observe a sampling of the pre-functional and start-up procedures. The sampling procedures are identified in the commissioning plan.
4. Subcontractors and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and pre-functional tests and checklists.
5. Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for supervisors to fill out these forms if they have not witnessed the test.

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup:

1. Subcontractors shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
2. CA reviews the report and submits either a non-compliance report or an approval form to the Sub or GC. The CA shall work with the Subcontractors and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the GC and others as necessary. The installing Subcontractors or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system using a standard form.

3.5 FUNCTIONAL TESTING

A. This sub-section applies to all commissioning functional testing for all Divisions.

B. Objectives and Scope of functional testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, equipment failure, etc. shall also be tested.

C. Development of Written Test Procedures shall begin with the CA obtaining all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CA shall then, with the assistance the contractor, develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Subcontractor or vendor responsible to execute a test, shall provide assistance to the CA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, Subcontractors shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

D. Test Methods shall include the following:

1. Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Altering Set points rather than overwriting sensor values, and when simulating conditions is difficult, altering set points to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout set point to be 2F above the current outside air temperature.
4. Setup of each function and testing shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

E. Coordination and Scheduling by the Subcontractors shall provide sufficient notice to the CA regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems. The CA will schedule functional tests through the GC and affected Subcontractors. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subcontractors shall execute all tests. In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation by the CA shall include witnessing and documenting the results of all functional tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review. CA will include the filled out forms in the Commissioning Report.

B. Non-Conformance.

1. CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported on a standard non-compliance form.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

a. When there is no dispute on the deficiency and the Subcontractor accepts responsibility to correct it:

1) CA documents the deficiency and the subcontractor response and intentions and they go on to another test or sequence

b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

1) The deficiency shall be documented on the non-compliance form with the Subcontractor's response and a copy given to the GC and to the Subcontractor representative assumed to be responsible.
2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
3) The CA documents the resolution process.
4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. Cost of Retesting for the Subcontractor to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
6. Contractor shall respond in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. CA retains the original non-conformance forms until the end of the project.

C. Approval by the CA shall include notation of each satisfactorily demonstrated function on the test form. CA recommends acceptance of each test using a standard form. The Owner gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.7 SYSTEMS AND OPERATION AND MAINTENANCE (O&M) MANUALS

A. Following System and O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Division 23 shall compile and prepare documentation for all equipment and systems covered in Division 23 and deliver this documentation to the GC for inclusion in the O&M manuals, according to this section, prior to the training of owner personnel.

C. CA shall receive a copy of the Systems/O&M manuals for review.

D. Special Control System O&M Manual Requirements shall include, in addition to documentation that may be specified elsewhere, the controls contractor compiling and organizing, at minimum, the following data on the control system in labeled 3-ring binders with indexed tabs:

1. Three (3) copies of the controls training manuals in a separate manual from the O&M manuals.
2. Operation and Maintenance Manuals containing:
    a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included if required in the controls specification section.
    b. Full as-built set of control drawings.
    c. Full as-built sequence of operations for each piece of equipment.
    d. Full points list. In addition to the updated points list required in the original submittal.
    e. Full print out of all schedules and set points after testing and acceptance of the system.
    f. Full as-built print out of software program as required.
    g. Electronic copy on disk of the entire program for this facility if required.
    h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.
    i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
    j. Control equipment component submittals, parts lists, etc.
    k. Warranty requirements.
    l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
3. Manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller / module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).
4. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.

E. Review and Approval of the commissioning related sections of the Systems and O&M manuals shall be made by the A/E and the CA.

3.8 TRAINING OF OWNER PERSONNEL

A. GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.

B. CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.

C. Mechanical Contractor shall have the following training responsibilities:

1. Provide the CA with a training plan two weeks before the planned training.

2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.
3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. Controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. Training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:

    a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. A review of the written Systems/O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
    c. Discussion of relevant health and safety issues and concerns.
    d. Discussion of warranties and guarantees.
    e. Common troubleshooting problems and solutions.
    f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
    g. Discussion of any peculiarities of equipment installation or operation.
    h. The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1-2007 is recommended.
    i. Classroom sessions shall include the use of overhead projections, slides, and video/audio-taped material as might be appropriate.

9. Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for all pieces of equipment.
10. Mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
11. Duration of Training by the mechanical contractor shall include providing training of sufficient length on each piece of equipment according to the requirements of the preceding specification sections. If not listed in the equipment sections, the following schedule shall be used:

Hours	System
10	Rooftop Units
1	Split DX AC Units
6	Exhaust Fans

D. Controls Contractor shall have the following training responsibilities:

1. Provide the CA with a training plan four weeks before the planned training.
2. Controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.
3. Training manuals shall include the standard operating manual for the system and any special training manuals which shall be provided for each trainee, with three extra copies left for the O&M

manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays. Copies of audiovisuals shall be delivered to the Owner.

4. Training will be tailored to the needs and skill-level of the trainees.
5. Trainers will be knowledgeable on the system and its use in buildings. The Owner shall approve the instructor prior to scheduling the training.
6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
7. Controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
8. There shall be three training sessions:

    a. Training I - Control System: The first training shall consist of 16 hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
    b. Training II - Building Systems: The second session shall be held on-site for a period of _16_ hours of actual hands-on training after the completion of system commissioning. The session shall include instruction on:

        1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.
        2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
        3) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
        4) Every screen shall be completely discussed, allowing time for questions.
        5) Use of keypad or plug-in laptop computer at the zone level.
        6) Use of remote access to the system via phone lines or networks if included.
        7) Setting up and changing an air terminal unit controller.

    c. Training III - General Overview: The third training will be conducted on-site six months after occupancy and consist of 8 hours of training. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

E. TAB contractor shall have the following training responsibilities:

1. TAB shall meet for 2 hours with facility staff after completion of TAB and instruct them on the following:

    a. Go over the final TAB report, explaining the layout and meanings of each data type.

    b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
    c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
e. Other salient information that may be useful for facility operations, relative to TAB.

3.9 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described and the filled out start-up, initial checkout, pre-functional, and functional checklists, training plans and records of training. These work products will be supplied to the CA to be included in the final commissioning report.

END OF SECTION

SECTION 23 09 00

CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and all referenced documents.

B. Comply with Sections 23 00 00 and 23 05 00, General Provisions, and all other Division 23 Sections, as applicable.

C. Refer to other Divisions for coordination of work with other trades.

1.2 SYSTEM DESCRIPTION

A. The scope shall include the furnishing and installing of Energy Management System devices with new direct digital controllers, all local and remote control panels, temperature control field devices, appurtenances, etc., to accomplish specific control sequences specified herein, to provide fire and freeze protection; cocks and wells for various temperature and pressure control, sensing and indicating devices; pressure and temperature indicating instruments; supporting structures, and other required components for a complete and operating system.

B. The scope shall include all new electric connections to new thermostats, sensors, valves, dampers, actuators, switches and relays, and all other new components of the system requiring electric connections. The scope shall further include all temperature control and interlocking wiring and wiring devices, including raceways, as indicated herein.

C. Provide all software programs as required to effect the sequences of control, monitoring, reporting, etc., as indicated herein.

D. The new system installed shall be fully automatic, subject to various types of remote surveillance, routine remote adjustments, remote status, remote alarms, remote data collection for trending/historical files, and other operations as indicated herein, from a new local remote microprocessor-based Local Area Network (LAN), with the local system capable of stand-alone operation. The system shall be capable of being monitored and controlled remotely on site by an IBM compatible Workstation and off site by a Central Work Station located at the Facilities Central Maintenance Office Service Center via modem and telephone line or Owner's WAN, or Ethernet LAN, where such exists and is allowed thereby. The entire system of control and automation at this building shall thus become an integral part of the existing facilities Energy Management System (EMS).

E. Bidders are specifically advised that full and effective two-way communication between the new system installed under this contract and the Owner's existing Central EMS must be achieved in an approved manner, including whatever may be required in the form of interface hardware and software without effecting or interrupting other system software. Simultaneous on-line communication of this system and others with the Central EMS is mandatory.

F. This system of equipment and software shall be provided and installed by the single local factory trained and authorized sales, installation and service agent of **Trane**. **Controls contractor shall include in the scope of work the upgrade of the existing control system as needed to fully communicate with the new version of the control system installed as a part of this project, which shall include any associated software or main building controller upgrades.**

1.3 QUALITY ASSURANCE

A. The equipment provided under this Section of the Specifications shall be installed, calibrated, adjusted, and put in completely satisfactory operation by a Control Systems installer experienced in this type of work.

B. The successful Control Systems installer shall meet the following requirements:

1. All spare parts must be locally stocked and readily available within a 24 hour period.
2. Service personnel shall be available, on call, on a 24 hour a day, year round basis, or service personnel will respond by visitation to the site within four (4) hours of a service call considered serious in nature or classified by the Owner as an emergency.
3. Be able to provide evidence of having successfully installed similar sized and types of systems for a minimum of ten (10) years.
4. Bids by wholesalers, distributors, mechanical contractors and non-franchised contractors shall not be acceptable.
5. All work described in the Plans and Specifications shall be installed, wired, and commissioned by factory certified technicians qualified for this work and in the regular employment of the control system manufacturer's local office.
6. A local office is defined as a corporate branch office or an independently owned office with a current contractural agreement with the system manufacturer that allows the office to purchase, install, and service the manufacturer's products.
7. The local office shall be full service facility within 50 miles of the project site. The local office shall be staffed with engineers and technicians trained on the installation, commissioning, and service of energy management and control systems.

C. All control devices shall be as specified in the technical portion of this section of the specifications. The system shall be installed by workmen skilled, experienced, and specifically trained in the application, installation, calibration, adjusting, and testing of instrumentation of the type specified.

D. All control system components shall operate satisfactory without damage at 110% above and 85% below rated voltage and at ± 3 hertz variation in line frequency. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. All bus connected devices shall be A.C. coupled, or equivalent, so that any single device failure will not disrupt or halt bus communications. Provide line voltage input protection to all network level controllers to protect these devices from over-voltage and lightning strike conditions.

E. A service representative of the installer shall check the instrumentation for proper installation, calibrate all instruments and make all adjustments necessary to insure proper operation of the system in full cooperation with the Testing, Adjusting, and Balancing (TAB) Firm. Refer to Section 23 05 93. All instruments required for checking, calibrating, and proving the system shall be provided under this Section of the Specifications. The service representative shall spend sufficient time with all of the Owner's Representatives after the system is installed and properly functioning to instruct the Owner's Representative (Operations and Maintenance Personnel) in the operation of the system for a minimum of sixteen (16) hours for the basic Controls System and twenty-four (24) hours for the EMS. At final completion of the installation provide personnel and instruments of satisfactory quality available to check the calibration of all instruments, and to demonstrate system operation as described in "Sequences of Operation".

F. All basic control devices, parts, and other materials, shall be standard catalog products of a single reputable manufacturer and shall essentially duplicate equipment which has been in satisfactory service for at least one (1) year. All materials and parts shall be items in current production by the manufacturers. First of a kind new technology devices will not be considered. Accessory equipment that is required to make a complete and functioning system that is not of the same manufacturer furnishing the basic control equipment shall carry the guarantee of the basic control equipment manufacturer and repair and replacement parts shall be available through normal local trade channels.

G. All software updates and enhancements which evolve during the first year warranty period following system acceptance, "Substantial Completion", shall be furnished to the Owner without additional cost. This shall include the local stand-alone direct digital controllers and the building network manager computer(s).

H. All network level controllers shall be native “ASHRAE BACNET” and shall communicate with all other BACNET Protocol communication systems at the building network level or be provided with a gateway which shall facilitate the building network level controller communicating with one of these systems.

1.4 SYSTEM START-UP AND COMMISSIONING

A. After completion of the installation, Contractor shall place the system in operation and shall perform all necessary testing and debugging operations of the basic systems and EMS.

B. An acceptance test shall be performed in the presence of the Testing, Adjusting, and Balancing (TAB) Company, to verify correct sequences of operation, calibration, and operation of the Controls and Energy Management System, when installed, with every part of the system functioning satisfactorily and having been fully commissioned, and with no outstanding items requiring completion or correction, the system will be accepted by the Architect and Owner for "Substantial Completion", and will then be placed under Warranty.

C. The Automatic Temperature Control and Energy Management System Installer shall thoroughly check all controls, sensors, operators, sequences, etc., before notifying the TAB Agency that the Automatic Temperature Controls and Energy Management System are operational. The Automatic Temperature Control and Energy Management System Installer shall provide technical support (technicians and necessary hardware and software) to the TAB Agency to allow for a complete check-out of these systems.

1.5 SUBMITTALS

A. Submittals shall be complete and be in full accordance with Section 23 05 00, Common Work for HVAC.

B. Submittals shall include complete, continuous line, point to point wiring diagrams including tie-in points to equipment with written sequences of control adjacent to pertinent control diagrams. Specification sheets shall be submitted on each piece or type of equipment in a separate brochure and show sufficient detail to indicate compliance with these specifications. Drawings and Specification sheets shall show set points, throttling ranges, actions, proportional bands, and integration constants, where applicable. Complete brochures shall include the wiring diagrams as well as operating and maintenance instructions on the equipment.

C. Complete and approved shop drawings shall be obtained prior to commencing installation work, unless otherwise approved by the Owner or Owner's Representative.

D. Tag numbers, as shown or specified, shall appear for each item on the wiring diagrams and data sheets. Data sheets shall properly reflect in every detail the specific item submitted.

E. After completion of the work, Contractor shall prepare and furnish maintenance brochures for the Owner. The maintenance brochures shall include operating instructions, specifications, and instruction sheets for all instruments and a complete set of "As-Built" control drawings. After approval of submittal, completion of all installation work, software checkout, and system commissioning in conjunction with the Testing, Adjustment and Balance (TAB) Firm, furnish to the Owner the following:

1. Three (3) sets of Blue or Black line prints of "As-Built" drawings, half size (11" X 17"), inserted in a three ring binder.
2. Three (3) copies of the final approved Shop Drawings in suitably sized three ring binders. This shall include copies of product data sheets and other operations and maintenance documentation.
3. A complete replacement spare parts list.

4. A back-up copy of the EMS settings and sequences of operation on a compact disc (CD). The CD shall include all of the files necessary to restore the EMS and controls systems to normal operation in the event of a system failure.
5. Two (2) labeled C.D.'s with all the information indicated above for items 1, 2, 3 and 4 in PDF format.

1.6 EMS SOFTWARE TOOLS AND LICENSES

A. Submit a copy of all software installed on the servers and workstations related to this project.

B. Submit all licensing information for all software installed on the servers and workstations.

C. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.

D. Submit all licensing information for all of the software used to execute the project.

E. All software revisions shall be as installed at the time of system acceptance.

1.7 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored, and which is damaged or defaced during construction shall be rejected.

B. Cover control panels, open ends of control piping and open ends of control valves stored on site until just prior to installation of wiring and valves respectively.

C. Storage and protection of materials shall be in accordance with Division 1.

PART 2 - PRODUCTS

2.1 TEMPERATURE SENSORS

A. Temperature sensors shall be nickel wire thermistor, 10,000 ohm resistance, or RTD Type, with 1000 ohms resistance at 70 Deg.F. and a 3 ohms/per degree F temperature coefficient. Sensors shall operate in a stable manner in a 5-95% relative humidity, non-condensing environment.

B. Ambient temperature limits shall be minimum of 0-125 Deg.F. with a +/- 0.5% (+/-0.35 Deg. F. or +/- 0.20 Deg.C.) accuracy at a nominal resistance equal to 70 Deg.F.

C. Temperature sensors and cabling used for temperatures below 60 Deg.F. shall be hermetically sealed to prevent condensation damage to conductors or elements. Sensors for immersion locations shall not be affected by vibrations encountered in normal piping systems.

D. Mixed air temperature sensors shall be the averaging capillary type to sense duct temperature across the full duct width. Minimum sensor length shall be 15 feet and include adequate supports for element within the duct or at the face of the coil, maintain minimum one inch (1") separation from coil.

E. Furnish sensors with maximum 6 to 9 inch insulated pigtail leads or trim sensor pigtail leads to meet this criteria once installed.

F. All sensor actions shall be the same for the entire building.

G. Mount all room wall sensors at 48" inches above finished floor to comply with A.D.A., unless indicated or approved otherwise by the Architect or Owner's Representative.

H. Wall space temperature sensors for normally occupied spaces shall include the following accessories, features and functions:

1. Normal Increase/Decrease Temperature Setpoint adjustments; limits set through software.
2. Impact Resistant Lexan type cover material.
3. Local override pushbutton to energize controlled equipment.
4. Local operator interface communication service jack compatible with mobile trouble shooting terminal unit. Alternately, provide spare service jack on terminal equipment controller on controlled terminal equipment.

I. Wall space temperature sensors in Common Public Areas (Corridors, Lobbies, etc.) shall include the following accessories, features and functions:

1. Impact Resistant Lexan type cover material.
2. Local operator interface communication service jack compatible with mobile trouble shooting terminal unit. Alternately, provide spare service jack on terminal equipment controller on controlled terminal equipment.

J. Sensors shall be as manufactured by Trane, or Veris Industries.

2.2 RELATIVE HUMIDITY SENSORS

A. Provide a 100% solid state copolymer wafer, of bonded layer hygrometric materials, humidity sensor and transducer. Sensor shall require no periodic maintenance or recurring calibration. Sensor shall be linear and temperature compensated.

B. Sensor shall have +/-2% Relative Humidity (RH) accuracy over a 100% RH range and +/-1% over the 30-80% RH range.

C. Sensor shall produce outputs of 4-20 ma or 1-11 vdc.

D. Sensor shall be in an impact resistant cover with ventilating openings in occupied spaces. Provide duct or remote mount probes as required for the application.

E. Wall mounted sensors shall be mounted 48 inches above finished floor to comply with A.D.A., unless indicated or otherwise approved by the Architect or Owner's Representative.

F. Acceptable Manufacturers:

1. Vaisala (±2% to 3% acceptable).
2. Trane (±2% to 3% acceptable.

2.3 CARBON DIOXIDE SENSORS

A. Furnish and install “CarboCap” technology (Vaisala) or Single Beam, dual wavelength, Infrared type technology (Tel-Aire) carbon dioxide sensors where indicated and as specified elsewhere herein.

B. Sensors shall accurately sense carbon dioxide levels from 250-2000 Parts Per Million (PPM) with an accuracy of ± 60 ppm (± 2% of range (2000 PPM) and ± 2% of reading (use 1000 PPM)), repeatability of ± 2% of full scale, maximum drift of ± 5% of full scale in five (5) years, ± 1% of full scale in six (6) months, and linearity of less than ± 3% of full scale.

C. Sensors shall be suitable for operation in environments of 60 Deg.F. to 104 Deg.F. and 15-95% relative humidity, non-condensing, and air velocity ranges of 200 to 2750 feet per minute when located in ductwork. Wall mount sensors shall be able to sense accurately with air velocities as low as 20 feet per minute.

D. Sensors shall be calibrated at the factory at 1,000 PPM, ± 50 PPM; at 72 Deg.F, ± 4 Deg.F.; and at 50% relative humidity, ± 5%.

E. Power requirements shall be 24 colts AC with a power consumption not to exceed 5 watts.

F. Wall mount sensors shall be mounted at 48-54 inches above the finished floor.

G. Sensors shall be as manufactured by:

1. Vaisala, Model GMD/W20 or equals by;
2. Tel-Aire(Model 8101/8102), or
3. Alternate models by Veris Industries.

2.4 COMBINATION SENSORS

A. Where space temperature, relative humidity and/or carbon dioxide sensors are all designated to be located in the same location for control or monitoring purposes combination sensors are desired such that one wall mounted device and single back box is required.

B. Where combination sensors are required the specified levels of accuracy will be required. The use of combination sensors does not relieve these requirements.

2.5 SMOKE DETECTORS

A. One (1) smoke detector shall be furnished and installed under Division 26 for each new rooftop unit over 2,000 CFM of airflow; to be mounted in the return air stream, which shall stop the fan motors upon detection of smoke.

B. Coordinate with Division 26 requirements to insure sampling tubes are provided suitable to the width of duct in which installed.

C. Detectors shall be supplied with 120 volts, or 24 volts, power supply under Division 26. Control circuit interlock wiring shall be under this section of specifications.

D. Acceptable duct detectors, where not specified elsewhere, shall be THORN-DH-22, BRK-DH2851AC, or Gamewell MS-69433, suitable for single station operation.

2.6 AUTOMATIC DAMPERS

A. Provide all control dampers, under this Section of the Specifications, of the types and sizes indicated on the Drawings, including but not limited to outside air intakes, return, relief, and other motorized air control dampers where shown, or where not an integral part of the equipment furnished and specified in other sections of these specifications. All dampers shall be special low leakage extended performance type.

B. Damper frames shall be not less than 16 gauge galvanized steel formed for extra strength with mounting holes for flange and enclosed duct mounting.

C. Dampers shall be available in two-inch size increments from 8" horizontal and vertical to 48". Requirements for dampers over 48" in size shall be met by using standard modules with interconnecting hardware to limit damper blade length to a maximum of 48". Provide separate actuator for damper modules exceeding 32.0 square feet and as required for smaller sizes due to torque requirements.

D. All damper blades shall be not less than 16 gauge galvanized steel roll formed for high velocity performance. Blades on all dampers must be not over 6" wide.

E. Blade bearings shall be nylon or oilite with 1/2" zinc plated steel shafts.

F. All blade linkage hardware shall be of corrosion-resistant finish and readily accessible for maintenance after installation.

G. Provide continuous replaceable neoprene or butyl rubber edging seals for all outdoor and relief air dampers where blade edges meet when dampers are closed. Spring loaded stainless steel side jamb seals shall be provided for all dampers.

H. Dampers and seals shall be suitable for temperature ranges of -20 degrees F to 200 degrees F at specified leakage ratings.

I. Dampers used for proportional control shall have opposed blades.

J. Leakage rates for all controlled dampers shall not exceed 5 CFM of air flow per square foot of face area based on a 16 square foot damper, at 1.0" W.C. differential, rated in accordance with AMCA 500. Furnish test data with submittals.

K. Acceptable manufacturers (No other manufacturers will be allowed):

1. Johnson Controls, Inc.
2. Honeywell, Inc.
3. American Warming and Ventilating, Inc.
4. Ruskin.
5. Nailor Industries, Inc.

2.7 ELECTRIC DAMPER ACTUATORS

A. All control dampers shall receive electric actuators.

B. Electronic direct-coupled actuation devices shall be provided.

C. Electric Actuators shall be direct-coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The fastening clamp assembly shall be of a "V" bolt design with associated "V" shaped toothed cradle attaching to the shaft for maximum strength and to eliminate slippage.

D. Spring return actuators shall have a "V" clamp assembly of sufficient size to be directly mounted to an integral jack shaft of up to 1.05 inches when the damper is constructed in this manner. Single bolt or set screw type fasteners are not acceptable.

E. Actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.

F. For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable. This applies to all dampers directly connected to outside and relief air systems. All spring return actuators shall be capable of both clockwise and counterclockwise spring return operation by simply changing the mounting orientation.

G. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control input and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. Floating point type control is acceptable on fan coil units, unit heaters and variable air volume terminals. All actuators shall provide for a 2 to 10 VDC position feedback signal although not used at this time. However, software feedback will be used at this time.

H. All 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 watts for DC applications. Actuators operating on 120 VAC power shall not require more than 10 VA.

I. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper or valve when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.

J. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation. Modulating actuators shall be compatible with the PWM output of the direct digital controllers.

K. Actuators shall be provided with a conduit fitting and a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

L. Actuators shall be Underwriters Laboratories Standard 873 listed.

M. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque and shall have a minimum 2-year manufacturer's warranty, starting from the date of Substantial Completion.

N. All actuators connected to all sequenced valves and dampers shall have independent control and adjustment from one another to emulate a pilot positioner.

O. Acceptable Manufacturer's:

1. Belimo.
2. Honeywell, Inc.
3. Johnson Controls, Inc.
4. Siemens.
5. Honeywell, Inc.

2.8 CURRENT SENSING STATUS RELAYS

A. Provide current sensing status relays for motor operation status monitoring as specified elsewhere herein.

B. Sensors shall be 100% solid state, no mechanical parts, and have no calibration drift.

C. Sensors shall have an adjustable trip level, be isolated, have single set point adjustment, require no external power (power induced from conductor), and have integrated adjustable wall or floor mounting bracket.

D. Sensors shall be suitable for motor loads from 0 to 100 HP, with a supply current of 1 ampere up to 135 amperes, 600 VAC RMS, set point adjustable to +/-1% range from 0-95% non-condensing relative humidity

E. Sensors shall be as manufactured by Veris Industries, Inc.

2.9 ROOM SENSOR AND THERMOSTAT PROTECTIVE COVERS

A. Provide opaque Lexan thermostat guards with mounting brackets and tamper proof screws for each new wall mounted thermostat and sensor installed as indicated on the drawings.

B. Guards shall be sized to accommodate the thermostat or sensor to be enclosed, and include ventilation openings, ring base, and key lock.

C. Guards shall be as manufactured aby:

1. Mason.
2. Honeywell.
3. Best Engineered Control Products.

2.10 AIR FLOW DIFFERENTIAL PRESSURE SWITCHES

A. Air flow differential pressure switches shall be provided to verify operating status of air moving equipment, where specified elsewhere herein, to sense flow in air ducts, and to detect clogged air filters, unless specified in other sections of these specifications.

B. Switches shall be capable of operating in ambient temperatures from 0 Deg.F. to 165 Deg.F.

C. Setpoints shall be field adjustable from 0.05 to 5.0 inches water column to suit the application. Provide concealed scale plate with adjusting screw for setpoint adjustment. Scale shall be selected such that the

normal operating range is at the midpoint of the scale; i.e. an operating range of 0.30 to 0.70 needs a scale of 1.0.

D. Materials of Construction:

1. Buna-N Diaphragm
2. Molded polycarbonate enclosure.
3. Zinc plated cold rolled steel; 0.040 inches thick for diaphragm housing and 0.032 inches thick for cover material.

E. Provide appropriate mounting brackets and any remote mounting probe kits as necessary for each particular mounting condition.

F. Acceptable Manufacturers:

1. Johnson Controls, Inc.
2. Honeywell, Inc.
3. Invensys.
4. Siemens.
5. Robertshaw.
6. Dwyer.

2.11 LOCAL CONTROL PANELS

A. New local equipment control panels shall be installed in each equipment room, or other locations as indicated or as required, for new electric equipment and control devices. They shall be totally enclosed, pre-piped, and wired to labeled terminals to house all associated controllers, thermometers, relays, switches, etc. serving that equipment. Provide one cabinet for each air handling unit or group of units in the same room.

B. Panels shall be mounted at a convenient height for access. Acceptable locations include mechanical equipment rooms, storage closets, electrical rooms, or other spaces as indicated on the Drawings. Above ceiling locations are not acceptable.

C. Thermometers, pilot light switches, and gauges shall be flush mounted on panel surface.

D. Cabinet frames shall be extruded aluminum sections with riveted corners supported by internal angle brackets. Door shall have continuous hinged door, with latch (and key lock for panels located below ceilings).

E. Sub-Panel and face panel shall be removable for ease of installation and replacement. Face panel shall be of a finished color with a finished frame.

F. Knockouts for 1/2" x 3/4" EMT connection and 1-1/2" x 1-1/2" trough shall be provided at top and bottom of panel.

G. Identify each panel, switch, and device by an engraved, bolt-on, black phenolic nameplate with white lettering securely attached. Identify all control devices inside panels similarly. Embossed plastic tape will not be acceptable on panel front faces but will be allowed on panel interiors.

H. Switches and pilot lights shall be mounted on the panel face with all other devices mounted inside the panel. Devices inside panels shall be wired to numbered dual terminal strips.

I. Start-Stop Pushbuttons and Pilot Lights, where called for, shall be of the low voltage and neon type. Pushbuttons shall be heavy duty type. Pilot lights shall be interlocked with starter auxiliary contacts except fans and pumps which shall have differential pressure sensors to indicate run status.

J. Each new control panel installed shall have a minimum of 25% consolidated spare/extra space available inside the panel for mounting of control devices for future system modifications or changes. This space shall be indicated on the panel shop drawing.

K. All wiring inside panels shall be concealed in a wiring harness.

L. Permanently affix inside each panel a final "as-built" control drawing of the piping and wiring of the panel.

M. All panels shall be factory assembled, piped and wired.

2.12 ENERGY MANAGEMENT SYSTEM

A. Network Level Controllers shall have a 16 bit based microprocessor with EPROM operating system. DDC programs and data files shall be in non-volatile EEPROM or flash memory to allow simple and reliable additions and changes. Each controller shall have an on-board 30 day battery backed real time clock.

B. Controllers shall be provided as required with capacity to accommodate input/output (I/O) points required for the application plus any spare points as specified. Each panel shall be provided with a socket for a Portable Operators Terminal (POT), and a port for network communications at no less than 78,000 baud. Controllers shall have outputs which shall be binary for On-Off control, with true variable voltage (0-10v), for driving analog or pneumatic transducer devices. Analog outputs shall have a minimum incremental resolution of one percent of the operating range of the controlled device. Controllers shall have LEDs for continuous indication of all bus communications, power, and operational status. All panel electronics and associated equipment shall be installed in suitable enclosures.

C. Terminal Equipment Controllers (TEC's) shall be UL916 standalone EEPROM based and configured to perform the sequences specified, and with I/O selected for the application. TEC enclosures shall be compact plastic conforming to UL94-5V or plated steel. Each TEC shall be provided with LED type annunciation to continually display its operational mode; power, normal, or in an alarm state. TEC networks operating on a 9000 baud rate shall be grouped with no more than 20 TEC's per primary bus connected device. For TEC networks operating over 50,000 baud, up to 100 TECs may be so grouped.

D. General:

1. Software development and programming shall be as directed by the Owner and as described herein. Contractor shall install all program operating time schedules as furnished by the Owner. During construction, the Contractor may operate equipment in what is considered a Construction Schedule. The control systems installer, at Substantial Completion, shall remove such schedules and replace these with individual, independent, operating schedules for each system and individual piece of equipment, specifically air handling equipment.
2. Program trend logging of all analog and binary points of control at intervals as directed by the Owner, initially use five (5) minutes.
3. Overall systems control shall be performed by a field programmable direct digital controller, microprocessor based, which incorporates Direct Digital Control, all necessary energy management functions and provides for digital display and convenient local adjustments of desired variations at each individual controller cabinet. This shall include scheduled programming and system interlocks.
4. DDC Control Units and all hardware shall be capable of continued operation at room temperatures of 40 Deg.F. to 120 Deg.F. and humidity from 10% up to a non-condensing point of 90%. All inputs shall be capable of withstanding continuous shorting to 120 VAC.
5. Provide any external electrical power supply protection devices to protect controllers from external voltage surges to include high voltage and lightning disturbances/protection.
6. Provide function switches in a local control panel if not integral with the DDC Controller with "on-off" control and a "manual-auto" switch for each new DDC output (contact type) with switch status information being available to the central systems historical data files for new heat pump units, exhaust fans over 2000 CFM in capacity. Switches shall be local and easily accessible and adjacent, or within sight of, controlled equipment. If switches are not an integral part of the Energy Management System or locally accessible for use, then furnish similar set of switches on the Local Control Panel, dip switches less than 1/4" wide and 1/4" tall shall not be acceptable for this function.
7. The new EMS system installed shall be automatic, subject to various types of remote site surveillance, routine adjustment, and operation as indicated herein, from a microprocessor-based Local Area Network (LAN), capable of stand-alone operation. In addition, basic control and LAN

interface shall be provided in a Central Control Panel located where shown on the drawings. The entire system of control and automation at this building shall thus become an integral part of the Owner's existing Energy Management System (EMS) front end.

8. Bidders are specifically advised that full and effective two-way communication between the new system installed under this contract and the Owner's existing CPU must be achieved in an approved manner, including whatever may be required in the form of interface hardware and/or software without effecting or interrupting concurrent communications with other connected buildings. No additional CPU's are allowed at the Central Digital Monitoring location.
9. Existing color graphic mouse commands shall be retained in a similar fashion.
10. Provide Control Graphics/Equipment Schematics for each piece of controlled equipment with on-line display of system control parameters. Program all graphics at system front end to include on-line alarm reporting resulting in print outs occurring each time an alarm message is reported on site.
11. Provide a hard wire connection between the Building LAN serving all new Controllers to the Central Facilities Management System. Verify dependable utilization of this system and transfer of local system data and functions to the existing control system CPU. General data reporting and alarms transmission shall be verified.
12. The existing central computer shall be used for digital parameter display, programmed to display analog variables, binary conditions, off normal scans and other analog or binary information required for analysis and adjustment of the system being remotely controlled. The existing central computer shall further contain display features to indicate automatic operation, manual or override operation, alarm indication, and other auxiliary displays associated with special purpose auxiliary function keys.
13. The associated keyboard at the existing computer shall contain all alphanumerical keys to call-up the desired points and type of value to be displayed and have several special dedicated keys for such functions as manual-auto, test and function and value, as an aid to the operator.
14. Energy Management System programs shall include, but not all are necessary utilized, but shall not be limited to:

    a. Optimal start-stop using an adaptive algorithm to prevent the need for manual adjustments of parameters.
    b. Optimization programs controlling equipment using outdoor dry bulb and dew point temperatures. The outdoor wet bulb temperature shall be calculated by the following equation:

       WB = (DB-DP)K+DP where K = 0.560-0.0068 (DP-30)

E. Control:

1. Control algorithms shall be available and resident in the digital system controller to permit Proportional, Integral, and Derivative control modes in any combination to meet the needs of the application. Other control modes such as incremental, floating, or two-position must be available to adapt to job needs.
2. All control shall be performed in a digital manner using the digital signal from the microprocessor based controller converted through electronic circuitry for modulation of electric actuators or through transducers to produce the pneumatic signal for operation of pneumatic actuators.
3. Provide sensitivity, proportional, and integral adjustments for all DDC output control points.

F. Energy Management: The digital system controller shall perform all the energy management functions necessary to reduce energy consumption. The programs shall include, not necessarily utilized, but not be limited to:

1. Optimal start-stop using an adaptive algorithm to prevent the need for manual adjustment of parameters.
2. Optimization programs controlling equipment using outdoor dry bulb and dew point temperatures. The outdoor wet bulb temperature shall be calculated by the following equation:
   WB = (DB-DP)K+DP where K = 0.560-0.0068 (DP-30)
3. Client Tailored Programs: The library of routines available in firmware must be capable of generating additional programs as may be required for specific client requirements. The Owner shall be capable of revising programs without the aide of the installer.

G. Local Display and Adjustment:

1. The DDC shall be provided with a Central Master Panel for digital parameter display, programmed to display analog variables, binary conditions, off normal scans and other analog or binary

information required for analysis and adjustment of the system being controlled. The DDC shall further contain display features to indicate automatic operation, manual or override operation, alarm indication, and other auxiliary displays associated with special purpose auxiliary function keys. Additionally, provide one portable operators terminal to make adjustments at any controller where connected to the network.

2. The associated keyboard shall contain all alphanumerical keys to call-up the desired points and type of value to be displayed and have several special dedicated keys for such functions as manual-auto, test and function and value enter, as an aid to the operator. A minimum of two keys shall be programmable for auxiliary functions that may be used frequently.
3. Adjustments of control variables shall be conveniently available at each local DDC panel or device through a resident or portable keyboard and display. The adjustments shall include, but not be limited to, proportional gain, integral rate, the velocity and acceleration constants associated with incremental control and on/off values of two-position control.

H. Field Programmable:

1. The Local DDC Controllers shall contain all necessary mathematic, logic, utility functions; and all standard energy calculations and control functions in ROM to be available in any combination for field programming the unit. These routines shall include, but not be limited to:

   a. Math Routines:
   b. Basic Arithmetic
   c. Binary Logic
   d. Relational Logic
   e. Fixed Formulas for Psychometric Calculations
   f. Utility Routines for:
   g. Process entry and exit
   h. Keyboard functions
   i. Variable adjustments and output
   j. Alarm Indication
   k. Restart
   l. Control Routines For:
   m. Signal compensation
   n. Loop control
   o. Energy conservation
   p. Timed programming

2. Final field programs shall be stored in battery backed up RAM.

I. Expandability: The DDC shall be expandable by adding additional field interface units that operate through the central processor of the DDC. The processor in the DDC shall be able to manage remote field interface units thereby expanding its control loop and energy management point capacity. Remote units shall be able to stand alone and have two-way communication in a LAN configuration. Systems furnished shall be fully manufacture-supported and under current production.

J. Calibration Compensation: To maintain long term analog accuracy to the controller sensing circuits, the DDC shall sense the voltage being supplied to the resistance sensing element and through firmware compensate for power supply changes due to long term drift or drift due to ambient temperature changes at the power supply.

K. Battery Backup: The DDC system shall be supplied with a minimum of 48 hours of nickel-cadmium battery backup, during power outages, for the RAM, with an automatic battery charger to maintain charge while power is on, to prevent internal component damage or failure. DDC modules shall have automatic restart capabilities with sequencing after a power failure without program interruption.

L. Associated Hardware:

1. Where electric actuators are used they shall be compatible with the (pulse width modulated) output of the Digital System Controller.
2. All actuators for valves and dampers shall be supplied under this section of the specifications.

M. Diagnostics: The Digital System Controller shall contain in its program a self-test procedure for checking the digital controllers, and by means of a non-destructive memory, check the computer.

N. Default Operating Procedure and Alarms:

1. All variables shall be identified as being reliable or unreliable. When a calculation is required to use a value (sensed or calculated), which is identified as being unreliable, the unreliable data value will flash. The calculation will use a default value programmed into the unit.
2. All alarms (a fan that did not start, etc.) and all deviation alarms (temperature, off, normal, etc.) will locally display an alarm as well as report to the remote CPU the type of alarm, designate equipment or system effected, date and time of alarm. A hard copy printout of alarms shall be generated at the remote CPU location. A scan can then identify all alarm conditions and their identifier.

O. Cabinet:

1. The DDC modules, central and remote units, shall be enclosed in a metal frame cabinet. The cabinet shall be constructed such that it can be mounted and electrical terminations can be made during the construction phase of the project. The DDC electronics are to be removed and added at a later date, only prior to start-up.
2. Cabinet shall be installed on the wall in the Mechanical Rooms or elsewhere as indicated.
3. DDC cabinets in Central Plant and Mechanical Rooms shall be provided with a key lock. All cabinets on each installation shall utilize one master key. Sheet metal set screw locking covers are not acceptable.
4. All control wiring and system communications shall be electrically terminated inside DDC cabinets.

P. U. L. Approval: The DDC system panels shall be an approved U.L. System, with U. L. listing as a Signaling System.

Q. General software features of system, with sufficient internal memory, shall include the following as a minimum (although not all are necessarily used):

1. Start-Stop Functions.
2. Optimized Start-Stop Control (warm-up and cool-down).
3. Time Programmed Commands.
    a. Normal occupancy.
    b. Holiday.
    c. Occupancy overrides.
    d. Schedules shall be programmable up to one year in advance with system wide or global scheduling and local, point by point scheduling.
4. Duty Cycle Control (not used).
5. Night Setback/Setup.
6. Electric Demand Limiting (not used).
7. Override Feature.
8. Run Time Totalization with data in non-volatile module memory. Provisions shall be made for on-line programming and override.
9. Staggered start of Groups of Equipment following power outages or Mass Building Equipment Shutdown.

R. Individual On/Off Points of System Control and run Status shall be provided for each of the following:

1. Exhaust Fans:
    a. EMS controlled Toilet Room Exhaust Fans; EF-A104, A105, A109A, A111, and A125.
    b. IDF Rooms: EF-A119.
    c. Electrical Room: EF-A123.

d. Crawlspace Exhaust Fan: EF-CS.
e. Laundry Room: EF-A122.
f. Locker Room Exhaust Fan: EF-A109B (Status Only).

2. Each Rooftop A/C Unit; Refer to plans for quantities, sizes and related requirements: RTU-1, 2, 3, 4, 5, and 6.
3. Each existing site lighting zone expanded in this project:

a. Minimum of two (2) zones. Provide contactors for all lighting zones. Coordinate with electrical drawings for locations of contactors.

S. Run Status (On/Off) of all units indicated above shall also be provided and shall be capable of being accessed for on-line programming. Status shall be by means of the local motor controller through the use of adjustable current sensing relays for all Package Roof Top A/C Units, split D/X units, and exhaust fans, using a current sensing relay on the evaporator fan motor for status on A/C units and fan motors for other constant flow air and handling equipment. Coordinate with control equipment furnished. Status for variable frequency drives will be obtained through the respective drive where such a feature exists.

T. Failure Alarm Status for the following EMS controlled items shall be provided through the EMS:

1. Combined Safety Alarm, one (1) for each RTU, and each EMS controlled fan.
2. Low/High Temperature Alarms for each temperature sensor installed, four (4) Deg.F. above or below set point, adjustable.
3. High Relative Humidity Alarm for each space and return air relative humidity sensor installed; on a rise above 65% R.H., adjustable.
4. High Carbon Dioxide Level Alarm for each carbon dioxide sensor installed, on a rise above 1300 Parts Per Million, PPM, adjustable.
5. Emergency Overflow Condensate Pan (suspended A/C equipment located above ceilings) Moisture Detection/High Water Level Alarm: De-energize unit served and sends alarm to the EMS. Provide high water level detection for all Roof-Top AC Units.
6. Polar Ionizer failure alarm for each polar ionizer installed.

U. Provide for two annunciation signals, one to indicate that the central heating system is operational and one to do the same for the central cooling system. This is a software feature for each separate heating and cooling system and shall be shown on the system graphics page.

V. Provide analog indication for the following:

1. For each Ductless Split AC Unit, provide analog indication of the following:

a. Space temperature, Deg.F. (For monitoring and alarm only).
b. Supply air temperature, Deg.F. (For monitoring and alarm only).
c. Space Relative Humidity, % RH.

2. For each new single zone rooftop A/C unit, provide indication for each of the following:

a. Supply air discharge temperature, Deg.F.
b. Zone space temperature, Deg. F.
c. Space relative humidity, % R.H.
d. Carbon Dioxide Level, PPM, where indicated in the sequence of operation or elsewhere herein.

3. Provide indication of outside air temperature in Deg. F for this campus.
4. Provide indication of outside are relative humidity in % R.H. for this campus.
5. Space Temperature, Degrees F:

a. IDF Room.
b. Electrical Room.
c. Laundry Room.

6. Space Carbon Dioxide Level, PPM, for:
    a. Gymnasium
7. Damper Position Feedback: On the graphical systems schematics CRT display provide indication of the valve and damper positions in % open; 25% open, 50% open, 75% open, etc. Program trend logs for each damper and valve installed.

W. Provide BacNET IP interface to each Inverter located in the Storm Shelter, One (1) total. Refer to plans for locations.

X. Provide BacNET interface between any site lighting control systems and EMS.

Y. Provide electrical Demand KW and Consumption in KWH metering device and installation under this Section of Specifications for the primary electrical service. Meters shall be as manufactured by E-Mon or Square D and shall be 460/3. Meter shall have BacNET IP or MS/TP interface communication capability and be able to measure and communicate to the EMS system amperage and voltage for each phase and associated kW, kWh and power factor. Energy Management System shall graphically show the instantaneous kW and kWh for each meter.

Z. Building Computer Software Management features:

1. Provide minimum of 15 User Selectable Passwords with a minimum of three levels of access. Highest level provides system access, secondary level provides access for command to field devices only, lowest level provides monitoring capabilities only with no field control allowed. Password access will be logged with time/date stamp and associated user ID.
2. Provide a minimum of 16 Point Group Summaries with each point inclusion selectable by system operator. Summaries will have a minimum of six character identifiers for each group. A separately selectable All Points Summary shall be available to the operator for a view of the complete system. Alarm Summaries, listing all points in an alarm status shall be provided, and shall be Owner definable.
3. Trend logs and summaries:
    a. The Network Manager, and existing Central Computer, shall be provided with, as a part of this contract, the ability to periodically trend any hardware, software, or simulated point within any of the attached DDC panels, for this project, at an Owner selectable interval of a minimum of once per second, up to at least once per 1000 minutes.
    b. The trending programming for selected points and all feature attributes of these points shall be accomplished online at the CPU with no disruption of dynamic communication with the remote DDC panels. The operator shall be able to add, delete, and modify points and attributes at any time while online. Online programmable attributes shall include:
    c. Point addition, deletion, and modification
    d. Sampling intervals and ranges
    e. Historical samples to be stored per individual point
    f. Dynamic data values
    g. Engineering units of each point
4. Online editing capabilities shall be provided for, but not limited to the following:
    a. Add/Delete Points
    b. Modify Engineering Units
    c. Modify/Create Point Groups
    d. Adjust Set Points
    e. Adjust Individual Start/Stop Times
    f. Trend Selected Points
    g. Observe Any System Point, Hardware, or Software
    h. This editing capability shall be for both CPU resident programs and remote DDC panel programs.

5. English language shall be used for all inputs, outputs, and display. Code or computer language will not be acceptable.
6. Remote DDC Field Communication: Communication between the Network Manager and the remote DDC panels shall be achieved via digital transmission utilizing a distributed polling technique for recognition of all field points both software and hardware points status issuing of commands, programming of DDC units, etc. Additionally provide software for the existing Central Computer to allow the same interaction/communication features as noted for the Computer Workstation Building. Data transmission via hardwire interlock shall be compatible with electric category type 3002 as described in Bell System technical publications for data transmission using 9600 Baud Rate.
7. CRT Format:
    a. The existing CPU located at the Facilities Central Maintenance Office CRT format shall include and display in an individually dedicated and protected area of the viewing screen the following Dynamic information:
        1) The current time, date, and day of week (including Holidays).
        2) Sequential as occurred alarms.
        3) Visual indication of “alarm”, “on” or “off” normal conditions which are active; All alarms to print out as they occur at the system front end.
        4) Current operator identification.
        5) Operator work area to display various forms of point information issue commands, and data base information relevant to current activities.
    b. Operator will have full access to the system for issuing commands, etc. while this display is active.
8. Provide a graphic software package and programming to result in a schematic illustration for each controlled piece or group of pieces, of equipment to illustrate all related controlled variables, setpoints and operating parameters. Additionally provide a building floor plan with room numbers and locations of all space sensors and controlled equipment. The user shall be able to click on any feature to pull up related system graphics.
9. Provide a portable operators terminal or fully operable and programmed laptop computer terminal for use by the Owners designated service technician to view, monitor and trouble shoot the control system via service jacks at all controllers and temperature sensors for each EMS type (manufacturer) furnished.

2.13 WEB BROWSER INTERFACE

A. Provide Internet/Intranet Connectivity utilizing a Web Browser as follows:

1. Shall be a “Server” based product that provides browser access to Ethernet enabled automation controllers. Access is accomplished by utilizing Microsoft Internet Explorer 11.0 or later. No other “client” side software shall be necessary to view and utilize the system. The “Server” hosting the Web Application can be located anywhere on the Internet. The software functions by taking real-time data from the active automation systems and combining that information with the appropriate graphic file in an HTML format to be viewed by the web browser. The number of simultaneous users connected to the web application shall only be limited by the capability of the server hosting the application. The application should be able to service multiple sites.
2. The graphics utilized for this system shall not require external applications to convert the images for use between the web server based application and the traditional graphical user interface. Graphics shall be interchangeable between applications.
3. Web Browser Server shall receive server-based software which shall support Microsoft’s .NET standards for the exchange and interoperability of information and data.
4. **Server-based software upgrades shall be free to the owner for the first five (5) years the server is owned by the building Owner.**

B. The Web Browser Interface shall include the following user configuration requirements:

1. Usernames and passwords can be setup via the Web Browser Interface. Physical access to the server is not required but will be password protected.
    a. Individual user names/passwords are to be utilized.

b. Usernames/passwords can be specifically unique to allow the user to be automatically redirected to a specific site, and or graphic display when logging into the system.

2. Passwords can be configured to allow the user to modify setpoints or not.
3. All user configuration functions shall be provided through an intuitive graphical user interface.
4. Web Browser Interface shall not require any external applications, “Client Side” software or “Plug-Ins” to connect, view, or control any aspect of the building automation system.
5. Access to the installed automation system shall be performed through Microsoft Internet Explorer.

C. Site Graphics shall meet the following requirements:

1. Graphics displayed through the Web Browser Interface must be the same graphic images provided through the Graphical User Interface described above. No external applications are to be required to interchange graphic images between the web server application and the graphical user interface.
2. Trend data must be able to be displayed graphically and in “spread sheet” format without the addition of any additional client side software, plug-Ins, or additional applications.
3. Digital Start/Stop Logging shall be able to be displayed and printed from the browser interface without the addition of any additional “client side” software, plug-Ins, or additional applications.
4. The display and printing of alarm data shall be performed without the addition of any “client side” software, plug-Ins, or additional applications.
5. Points that are manually overridden shall be displayed on the graphic screen by an icon adjacent to the overridden point to provide a quick visual indication of any points on the screen that are overridden.
6. The viewing and modification of weekly schedules shall be performed in a graphically intuitive manner that is consistent with the non-Web Enabled application. This shall be performed without the addition of any “client side” software, plug-Ins, or additional applications.
7. The viewing and modification of annual holiday schedules shall be performed in a graphically intuitive manner that is consistent with the non-Web Enabled application. This shall be performed without the addition of any “client side” software, plug-Ins, or additional applications.
8. “Right clicking” on the point and modifying the value shall perform the editing of point values.
9. Points can be placed in “manual” or “automatic” mode from the Web Browser, providing password restrictions for the user allow such functionality.”

D. All Graphics shall be approved by District and Engineer prior to use.

2.14 ELECTRICAL WIRING

A. All wire, wiring, and conduit required for the operation of the control system shall be the responsibility of this section of the specifications and shall be installed as described and in full accordance with the requirements of this Section of these Specifications.

B. The control manufacturer shall be responsible for supplying complete and approved wiring diagrams and installation supervision of the wiring of the control system and shall perform all necessary set-up and calibration labor.

C. Starters are all existing. Field verify existing provisions. All wiring from auxiliary contacts or relays shall be performed under this section of the specifications.

D. All wiring, including both Class 1 and Class 2 signal wiring, shall be installed as a Class 1 electrical system as defined by the National Electrical Code (NEC) version adopted by the local municipality in which the work will be performed., except that plenum rated cabling (no conduit) may be used in above accessible ceiling locations where fully concealed. No exposed wiring of any kind will be allowed.

E. The electrician shall be licensed by the City and local authorities having jurisdiction over the area in which the work is to be performed.

F. All class 1 control wiring conduit shall be run with not more than 30% fill based on inside conduit diameters and cross-sectional area. This provision is for future modifications or additions to the control system. Provide a pull string in the conduits for future use.

G. All conduit carrying shielded twisted pair cabling, communication, or signal, Class 2 wiring, shall be sized for a maximum of 40% fill based on inside conduit diameter and cross-sectional area. This provision is for future modifications or additions to the control system. Provide a pull string in the conduits for future use as indicated elsewhere herein.

H. All wiring shall be run in conduit. All Class 1 power wiring shall be run in conduit. All Class 2 signal wiring, low voltage control type, shall be run in conduit, except where otherwise indicated therein. No exposed wiring of any kind will be allowed. Class 2 signal wiring may be installed without conduit but only when installed above fully accessible lay-in ceilings and if run-in plenum rated cable supported independently from structure and run parallel and perpendicular to the structure.

I. All conduit shall be 3/4 inch size minimum, except raceways terminating at control devices manufactured with 1/2" knock-outs, i.e., conduit from junction box to smoke or fire detectors (local single device wiring only).

J. Electrical Systems Installer on project may perform temperature control conduit and wiring installation on project only that this portion of work shall be bid directly to the Temperature Control Systems Installer, and all work in relation to temperature control wiring shall be done subordinate to this Section of the Specifications. All wiring terminations shall be under this Section of the Specifications.

K. Under this Section of Specifications, coordinate the furnishing and installation (by the electrician) of galvanized steel back boxes for all wall mount space sensors, suitably secured with 3/4" EMT routed to four inches (4") above an accessible ceiling. This will also require the installation of pull wire for installation of sensors and related wiring at a0020later stage of construction under this Section of Specifications. Use flexible conduit fished down walls as required.

L. Work Not Included Under this Section of Specifications: The Electrical Systems Installer shall provide:

1. Branch circuit and motor feeder circuit conductors, raceway, connections, and overcurrent protection for each motor or item of equipment furnished by the Owner or other Contractors. Installation of branch circuit and feeder circuit conductors, raceway, and connections shall be in accordance with the manufacturer's approved wiring diagrams.
2. Disconnect switches, where indicated on the drawings or required by local Codes.
3. Power supply conductors, raceway, connections, and over-current protection for input power to HVAC Temperature Controls, HVAC Automation, and HVAC Energy Management Systems in accordance with approved rough-in and connection diagrams furnished by the system suppliers only when shown on Division 26 Drawings.
4. The above represents an outline of the work for the purpose of describing one division of the work which is acceptable to insure that all work is contained within the General Contract. The Contractor is fully responsible for the installation of complete, operating systems in accordance with the functional intent of the specifications.
5. Nothing herein shall be construed to confine the Contractor from assigning the work to any single member or group of systems installers deemed best suited for executing the work to effect completion of the contract. Refer to specific bidding instructions of the General Contract for the actual division of the work.

M. Work Included Under this Section of the Specifications: The Mechanical Systems Installer shall provide:

1. Motors and equipment, erected in place and ready for final connection of power supply wiring, along with manufacturer's approved wiring diagrams.
2. Motor controllers, in suitable enclosures and of the type and size in accordance with the manufacturer's recommendations and NEMA requirements, along with properly sized overload elements or devices which are normally provided as part of manufactured equipment.
3. Disconnecting switches or devices which are normally provided as a part of manufactured equipment.
4. Rough-in and connection diagrams for input power supply and connections for the HVAC Temperature Control, HVAC Automation, and HVAC Energy Management Systems.
5. The above represents an outline of the work for the purpose of describing one division of the work which is acceptable to insure that all work is contained within the General Contract. The Contractor

is fully responsible for the installation of complete, operating systems in accordance with the functional intent of the specifications.

N. Contractor, under this Section of the Specifications, shall insure the furnishing and installation of:

1. All new branch circuit wiring, conduits, protective devices and accessories for power wiring to serve new control panels, control transformers, electric control dampers and valve actuators, combination fire-smoke dampers and any other control system power requirements where not shown to be performed by others. Field verify spare electrical circuits available where applicable. Do not tap into existing branch circuits without approval by the Owners Representative. Run all new circuits back to electrical feeder panels.
2. Conductors and raceways for the HVAC temperature control, HVAC automation, and HVAC Energy Management System in accordance with approved rough-in and connection diagrams furnished by the system suppliers.
3. Termination of all conductors, raceways, devices, and connections for low voltage systems for the HVAC Temperature Control, HVAC Automation, and HVAC Energy Management Systems in accordance with the provisions of Division 26, and approved systems shop drawings to provide complete operating systems in accordance with the functional requirements of the specifications.

O. Wire all safety devices in series to include freezestats, firestats, smoke detectors, and static pressure high limit controls; any single device when tripped, shall de-energize air handling equipment.

P. Wiring Requirements shall also include the following:

1. The conduit/wiring system required for the basic electric controls and Energy Management System shall be a complete and operating system. Conduit sharing with other unrelated electrical systems is not permitted.
2. All wiring shall be labeled at both ends and at any spliced joint in between. Wire and tubing shall be tagged using 3M, Scotch Code Write On Wire Marker Tape Identification System; product number SWD-R-11954 with 3/4" x 5/16" write-on area or SLW 12177 with 1" x 3/4" write-on area and with 3M Scotch Code SMP Marking Pen. In addition to tagging at field device end and at spliced joints, a tag shall be placed 6" after entering each DDC panel. Identification and tag information shall be included in engineering/wiring submittal which must be submitted for Owner approval prior to beginning work. Tag information shall coincide with equipment/point information as written in the specification Input/Output summary.
3. Digital Input (D.I.) wiring (Class 2) may be run in a common conduit with Digital Output (D.O.) Wiring (Class 1) where local codes permit.
4. Analog Input (A.I.), Analog Output (A.O.), Digital Input (D.I.), and Network Communications Trunk (N.C.T.) wiring may be run in a common conduit.
5. Digital Output (D.O.) wiring run in a common conduit with Analog Input (A.I.), Analog Output (A.O.), or Network Communication Trunk (N.C.T.) is not permitted under any circumstances.
6. AC line power to DDC panel shall be #12 THHN.
7. Digital Output (D.O.) wiring shall be #14 THHN.
8. Digital Input (D.I.), Analog Input 4-20 mA (A.I.) and Analog Output (A.O.) wiring shall be #18 TSP (twisted shielded stranded pair with drain wire).
9. Analog Input or voltage types (A.I.) wiring shall be #18 TSP (twisted shielded stranded pair with drain wire).

2.15 GENERAL

A. System shall be installed complete with DDC panels, remote panels, thermostats, sensors, control dampers, all actuators, switches, relays, alarms, etc., and control conduit in accordance with the extent of the sequences of operation. Provide all auxiliary equipment required. All controls shall be installed under this section of work, with the exception of automatic dampers and taps for flow switches and pressure sensing devices which shall be furnished under Sections 23 30 00.

B. Control Systems manufacturer shall submit a complete and final check list verifying final calibration and set points for each system prior to final construction review.

C. Complete control drawings shall be submitted for approval before field installation is started. The submittals shall give a complete description of all control devices and show schematic piping and wiring, as well as a written sequence for each operation.

D. All control dampers shall be furnished by Control manufacturer and shall be set in place, under other sections of the specifications, and be adjusted for proper operation, including the installation of necessary linkages with actuators under this section of specifications. Contractor shall also furnish, under other sections of the specifications, install any necessary blank-off plates required to fill duct when damper size is smaller than the duct. All outside and relief air damper frames and blank-off plates shall be caulked air tight with non-hardening silicone caulking to the ductwork or frame opening.

E. Work under this section shall regulate and adjust the control system, including all controllers, thermostats, relays, control valves, motors, and other equipment provided under this contract. They shall be placed in complete operating condition subject to the approval of the TAB firm. Contractor shall cooperate fully with the balancing agency in the testing, check-out and adjustment of the various systems. Contractor, under other sections of these specifications, shall install all wells, valves, and automatic dampers.

F. Control system herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from the date of "Substantial Completion", any of the equipment herein described is proven to be defective in workmanship or material (except electrical wiring done by others), it shall be adjusted, repaired, or replaced free of charge.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION - ROOFTOP UNITS (SINGLE ZONE TYPE)

A. The direct digital control system shall monitor and control each rooftop A/C unit. An electronic room temperature sensor shall, through a local terminal unit DDC Controller, one per unit, control its DX Cooling (minimum 2-stage for all units), hot gas reheat coils, 1 or 2-stage or modulating gas heaters, economizer and outside, return and relief/exhaust air dampers, as applicable, to provide the following sequences:

1. The DDC controller shall be of the automatic change-over type to provide for a heating and a cooling set point to be software interlocked to prevent the cooling set point from being set below the heating set point and vice-versa. Provide for a minimum 2 Deg.F. dead band between set points, adjustable up to 5 Deg.F.
2. Include optimized start and stop features for unit control where the space temperature is compared to the ambient outdoor air temperature to calculate the minimum run time necessary to attain the normal mode set point by the occupied time scheduled.
3. Any time the rooftop A/C unit is in operation in the “Occupied” mode, the outdoor air damper shall open to its minimum position except during morning warm-up (optimized start), night set-back, morning cool-down (optimized start) and night set-up.
    a. For units specified to have carbon dioxide sensors (RTU-1, 2, 3, and 4), the outside air dampers shall remain closed in the occupied space, except when the unit is operated in the normal occupied mode in which case the outside air dampers shall open to the minimum-minimum position scheduled. Once the carbon dioxide set point of 1,100 PPM, adjustable, is reached; the outside air damper shall modulate further open to maintain this set point but in no instance shall it open beyond the minimum-maximum position scheduled.
    b. For Locker Room unit, RTU-5, the outside air dampers shall modulate to the minimum-maximum position when the respective existing locker room fan (EF-A109B) serving the space is energized. When this fan is de-energized the outside air damper shall return to the minimum-minimum setting.

4. Upon a need for mechanical cooling, the DX cooling system shall be energized in such a manner as to maintain a stable space temperature set point of 74 Deg.F (adj.). On a rise above set point the 1st stage of cooling, first compressor, shall be energized. For multi-stage units the additional compressor or stage will only be energized upon a further rise above set point and when the previous compressor or stage has been on longer than 5 minutes, adjustable. On a decrease in demand for cooling the compressors or stages shall be cycled off in reverse order to being energized. On a further decrease in space temperature, the first stage compressor shall be cycled off. Each stage of cooling shall have a minimum off time of approximately 5 minutes (Variable as determined through PID loop control).
5. The space relative humidity (R.H.) sensor shall, through its DDC controller output signal, cause the unit to go into the dehumidifcation mode only when there is not a sensible cooling demand; and, upon a rise in space R.H. above set point, 60% R.H., adjustable. All units shall have a hot gas reheat coil, energized via a hot gas solenoid valve, which shall be used to reheat the supply air to a nearly neutral temperature only when in the dehumidification mode. Provide R.H. sensors for all units. Should the space temperature drop to below the heating set point, the dehumidification mode shall be de-energized and the gas heat shall be allowed to cycle on as needed to satisfy the heating set point once the compressor is cycled off.
6. The heating temperature set point shall be 72 Deg. F., adjustable. On a drop in space temperature below heating set point, the furnace section shall be energized, in stages, as required, to maintain set point. The cooling system and hot gas reheat shall be de-energized while heating with natural gas. A supply air high limit control feature shall be provided to prevent the supply air temperature from raising above 90 Deg.F. by overriding and de-energizing the heat as required. The heat, when a demand for heat remains, shall shut-off for a minimum of three (3) minutes, adjustable, and be energized when the supply air temperature drops (fan runs continuously) below 80 Deg.F., adjustable. For 2-stage or modulating heating units, the furnace heating sections will stage on as required to meet demand in a stable fashion.
7. When the outdoor air temperature is below 65 Deg. F., adjustable, the economizer dampers shall modulate, in sequence, as required, to satisfy the space temperature sensor's cooling set point. If the economizer cannot satisfy the space temperature set point (100% open) then energize the cooling system of compressor(s), as required. No enthalpy or return air comparison economizers allowed. Should the space relative humidity rise to 60% RH, adjustable, while in the economizer mode inversely reset the outside air dry bulb set point downward until the relative humidity drops to below 60% R.H. (use a 4% R.H. differential). Carbon dioxide sensor control shall be disabled when the unit is in the economizer mode.
8. An evaporator motor current sensing relay will be interlocked through the DDC system in such a manner that anytime the unit fan is de-energized the gas fired heat and cooling compressors will also be de-energized unless operated for a heat purge sequence upon furnace shutdown after which time the furnace will shut down.
9. Space temperature sensors will also be used to operate the units in the unoccupied modes of operation.
10. During the optimized start morning "warm-up" mode (winter), the air unit fan motor will be cycled on and the unit furnace will be energized, as required, to bring space temperature to the normal heating set point. During this mode the outdoor air damper will be closed. When the space reaches warm-up set point, one (1) Deg.F. below the heating set point, the unit will then be allowed to operate in the "occupied" mode at which time the outdoor air damper will be allowed to open to minimum position, or be controlled by a carbon dioxide sensor as indicated elsewhere herein, and the system will be controlled as described above. Warm-up shall occur not more than once each day. The discharge air temperature high limit control sequence shall remain in control during the morning warm-up mode.
11. During the optimized start morning cool-down (summer) mode, the air unit fan motor will be cycled on and the unit cooling system will operate at the capacity as required to bring the space temperature to the normal cooling set point. During this mode, the outdoor air damper will be closed. When the space reaches cool-down set point, one (1) Deg.F. higher than the cooling set point, the unit will operate in the occupied mode at which time the outdoor air damper will be allowed to open to its minimum position, or be controlled by a carbon dioxide sensor, as indicated elsewhere herein, and the space temperature sensor will control as described above. Cool-down shall occur not more than once each day.
12. During the night set-forward and night set-back modes the equipment will be cycled as required to maintain those set points; on at 85 Deg.F. and off at 80 Deg. F., adjustable, for set-forward and on at 55 Deg.F. and off at 60 Deg.F., adjustable, for night set-back. The outdoor air dampers shall be

closed in both of these modes. The discharge air temperature high limit control sequence shall remain in control during the night set-back mode.

B. The rooftop A/C units shall be furnished with factory assembled modulating economizers with digital controller which shall be interfaced in such a manner as to:

1. Allow the mechanical cooling system to be locked out and economizers to be enabled and disabled as hereinafter described. However, should the economizer be unable to maintain the cooling set point, the mechanical cooling system shall be energized as needed.
2. Digital controller shall be interfaced in such a manner that when the A/C unit is in the economizer mode of operation it shall be controlled so it opens the outdoor air, above minimum setting, where applicable, only on a cooling demand by the space temperature sensor.
3. Instrumentation and Control system provider shall furnish and install all necessary signal conditioners, relays, etc. to perform the economizer interface as described herein. Coordinate these requirements with each specified equipment manufacturer.
4. Provide for a discharge air temperature control, which shall prevent the discharge air temperature from dropping below 53 Deg. F., adjustable, when the unit is operated in the economizer mode. Override the economizer dampers as needed to achieve this low limit condition. Coordinate this provision with each specified equipment manufacturer.

C. For RTU's-1, 2, 3 and 4 provide a wall mounted carbon dioxide sensor. For RTU-2, 3, and 4, provide a single common wall mounted carbon dioxide sensor per space served by respective units. In either arrangement, the senosor shall modulate, via an analog signal to the rooftop unit, the return and outside air dampers, in sequence, to maintain a maximum level of 1100 Parts Per Million (PPM), adjustable. The return damper shall modulate from its fully open position to the corresponding sequenced position with the outside air damper, which shall go from its fully closed position up to its maximum-minimum value scheduled. The return air damper shall have a software safety interlock that will not allow it to go past 50% closed during mechanical cooling. Carbon dioxide sensor control shall be locked out when the unit enables the economizer cycle.

D. Should the space temperature drop to 1 Deg.F., adjustable, below heating set point while the RTU is operating in the dehumidification mode, the unit shall go into alarm and revert to fan and compressor or furnace cycling (on-off) to meet space temperature (sensible load only) requirements until reset.

E. RTU-2, 3, and 4 share a common single humidity sensor in each space.

F. Two temperature sensors shall be provided for the units noted below in the table. The sensors for each unit shall be noted as primary and secondary as follows:

UNIT	PRIMARY SENSOR SPACE	SECONDARY SENSOR SPACE
RTU-5	Boys Athletics A109	Coaches Office A110

The primary sensor shall control heating and cooling set point, unless the space temperature in the secondary space is greater/less than 2.5 Deg. F., difference from set point. When this occurs, the secondary sensor shall control the heating and cooling set point until such time as it is within in 1 Deg. F. of space set point. Once this temperature is reached, the primary space temperature sensor shall return to being the control sensor for the unit.

G. For multiple units serving a common space, units shall stage on to maintain space temperature for portion of portion of space served.

H. Unit Ionization Device:

1. Each unit provided with an ionization device (see mechanical schedules for listing) shall be enabled/disabled via interlocking with the supply fan control. After a 1-minute delay on a call for supply fan operation, the ionization devices shall be enabled. The EMS shall monitor the device for faults via dry contacts provided on the device. An alarm shall be generated if a fault is observed.

3.2 ELECTRIC UNIT HEATERS

A. Electric unit heaters shall be controlled by manufacturer furnished thermostats set at 68 Deg.F. (adjustable). On a fall in temperature below 68 Deg.F., the unit heater fan shall be energized after which the stages of heat shall be energized in sequence as needed to satisfy the set point. On a 2 Deg.F., adjustable, rise above set point, the heater will be de-energized in a reverse fashion of that described above.

B. Mount thermostats, under this Section of Specifications, on wall where indicated on the Drawings. Provide interlocks to any other devices, exhaust fans and intake dampers as scheduled. For ceiling and wall unit heaters the thermostat shall be integral to the unit.

3.3 SEQUENCE OF OPERATION - EXHAUST AND VENTILATION AIR FANS

A. Where fans are designated to be thermostatically controlled, on a rise in space temperature above 78 Deg.F., the respective fan controlled shall be energized. For fans with two temperature sensors, the fan

shall control to the greater of the two sensors. When a fan is energized, the respective make-up air dampers, where indicated on the Drawings, shall be opened. On a fall in temperature to 75 Deg.F., the fan shall stop, and interlocked dampers shall be closed. Where fans are to be interlocked with heaters serving the same space, coordinate the furnishing of combination heating-cooling thermostats (individual thermostats for the fan and heater not allowed) such that heating and cooling cannot occur simultaneously

B. Install fan speed control switches at a convenient location on direct drive fans on the load side of the disconnect. Refer to equipment schedules on the Drawings for direct drive fan designation. Fan speed controllers are furnished with the fans as specified under other Sections of these Specifications.

C. Other exhaust fans shall be interlocked, be provided with locally manually controlled motor rated toggle switches with pilot lights where manual switches are scheduled and where specified in other sections of these specifications.

D. EMS controlled fans shall run continuously during normal occupied mode and be de-energized during all other modes of operation.

E. The underfloor, crawl space, shall be mechanically ventilated by roof mounted exhaust fans which shall be cycled on as described herein. The intake air shall be introduced through open areaway vents (no dampers required). Anytime the outside air temperature is above 35 Deg.F., adjustable, the exhaust fans shall be energized for timed intervals every 24 hours. This system shall be energized for two (2) hours and be off for one (1) hour, both adjustable, repeatedly and continuously over a 24 hour period such that the system operates for a total of 16 hours and is off for a total of 8 hours. Anytime the outside air temperature is below 45 Deg.F., adjustable, the fans shall stop. Lock-out time schedule operation when the outside air temperature is below 40 Deg.F., adjustable. Additionally, provide a crawl space relative humidity sensor, one per crawl space (2), to be located in the crawl space immediately adjacent to the respective floor access hatch (refer to Drawings). Whenever the relative humidity in the crawl space rises above 60% R.H., adjustable, override the time schedule and operate the exhaust fan until the relative humidity drops below 55% R.H., adjustable.

F. Locker Room exhaust fans shall be interlocked with a 0-4 Hr No Hold timer to control the operation of the exhaust fan and allow for the locker room exhaust fan to automatically turn off after the specified time period.

G. Storm Shelter Ventilation: Ventilation fans VF-1 and 2 shall be hard wired interlocked with the storm shelter activation switch located in the Storage Room to energize the associated fans to run until the switch is turned off. The fans shall be controlled by VFDs powered through the central inverter for the storm shelter. The VFDs shall be set at full speed setting as determined by the TAB firm. The VFDs shall

only be used for ramp-up to minimize inrush current and shall not be used to modulate the airflow of the fans.

3.4 SEQUENCE OF OPERATION – DUCTLESS SPLIT DIRECT EXPANSION (DX) AIR CONDITIONING UNITS

A. Wall mounted and discharge air temperature sensors shall be provided and installed under this Section of Specifications for monitoring and alarm purposes only.

B. A unit manufacturer furnished thermostat, furnished under other Sections of these Specifications, shall be installed under this Section of Specifications. The cooling set point shall be 72 Deg.F., adjustable. On a rise in space temperature above set point, energize the cooling system. On a 1-2 Deg.F., adjustable, drop below cooling set point, the system shall be de-energized and the compressor and fan shall both cycle off.

3.5 SEQUENCE OF OPERATION - NIGHT SET-BACK AND SET-UP MODES

A. A night set-back and set-up modes shall be provided to keep equipment from operating except as needed to heat or cool the space to protect the building systems from freezing and potential water damage or from excessive heat or humidity build-up.

B. Designate a space temperature sensor, to be located on an interior partition within 8 feet of a Northern exposure, selection as recommended by the balancing agency, to be used for night set-back control. Sensor, adjustable, shall be set for 55 Deg.F. Provide one per AHU or system. For single zone systems, utilize the space sensor shown. Use this same sensor for night set-up which shall have a set point of 82 Deg.F., adjustable.

C. Below set-back setpoint, respective air handlers shall receive a control signal, fans shall be energized, and related Central Plant distribution pump(s), boiler(s), as required to maintain minimum condenser water loop temperature to above 50 Deg.F., adjustable, shall be started if not already energized, until all units are no longer in the night set-back mode. Above the night set-up set point, respective air handlers shall receive a control signal, fans shall be energized and related Central Plant distribution pump(s) and cooling tower(s) as required, to maximum loop temperature to no higher than 85 Deg.F., adjustable, shall be started if not already operating.

D. During the night set-back mode, lockout, ventilation cycles, morning warm-up and cool-down modes, night set-up mode, close all outside and relief air dampers and de-energize all EMS controlled toilet exhaust and relief air fans located in the spaces served. During the night set-up mode, lockout the same systems, except lock-out the heating system and set-back mode.

3.6 SEQUENCE OF OPERATION - MORNING WARM-UP AND COOL-DOWN MODES

A. A warm-up and cool-down modes shall be provided to warm or cool the building, or area served by a system, to within 1 Deg.F. of the normal occupied heating or cooling set point, adjustable, through the building Energy Management System optimized start feature.

B. Warm-up shall function the same as night set-back, except the set point shall be as noted above. Cool-down shall function the same as night set-up, except the set point shall be as noted above.

C. Lockout the warm-up mode after the cycle is completed until the following scheduled cycle, generally not to occur more than once per day. Lockout the cool-down mode after the cycle is completed until the following scheduled cycle, generally not to occur more than once per day.

D. During the warm-up mode, lockout cooling tower system, ventilation cycles, night set-back, morning cool-down, night set-up, close all outside and relief air dampers and de-energize all EMS controlled toilet

exhaust fans. During the cool-down mode, lockout the same systems, except allow the cooling tower system to be energized and lock-out the heating water system.

3.7 ELECTRICAL INTERLOCKS

A. Certain electrical interlocks shall be as listed herein and in other sections of these specifications.

B. All electrical interlocks shall be made by means of auxiliary contacts on motor starters or shall be accomplished with separate relays unless indicated otherwise. No motor power lead shall be utilized in an interlock circuit, unless indicated otherwise. Each separate control power lead serving a starter shall be provided with a disconnecting switch suitably identified and housed, which may be a toggle switch or other suitable disconnecting device, of proper capacity and number of poles.

3.8 TEST, ADJUST, AND BALANCE SUPPLEMENTARY PROVISIONS

A. Under this section of the specifications, provide a temperature test port adjacent to all duct mounted EMS sensor locations. Additionally, furnish any other permanent test tees or wells for sensor calibration and for verification of all system monitoring data.

B. Under this section of the specifications, provide all pressure taps, sensors, wiring/cabling, etc., to be connected to the Energy Management System to include all points necessary for the sequence of operations specified hereinafter.

C. Assist the TAB Agency in all sensor calibration and during all functional performance testing of controls, basic and devices and EMS controlled equipment.

3.9 DDC CONTROL

A. Provide complete DDC Control for all equipment as indicated elsewhere herein.

B. Not more than one local unitary direct digital controller shall be utilized per AHU/piece of equipment. Each DDC controller used for Global System control and for air handling units shall have their own real time clock.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Owner furnished General Requirements and referenced documents.

B. Comply with all other Division 23 Sections, as applicable. Refer to other divisions for coordination of work with other portions of Work.

1.2 SYSTEM DESCRIPTION

A. Furnish and install all piping of every kind required, specified, or shown on the Drawings for the installation of the work specified in Division 23. The location, direction, and size of the various lines are indicated on the Drawings. Lines for pilot and controls and instrumentation are not shown but shall be installed as required and as specified.

B. Piping systems shall include all appurtenances shown on the drawings and specified herein.

C. Valves or cocks shall be installed to control the flow of water to each of the various systems, to segregate individual items of equipment and parts of fluid circulating or supply systems, and to permit draining of systems or portions thereof, to blow-off strainers, etc., as directed on the Drawings and specified.

D. The work shall include the furnishing and installing of all supporting structures and members for pipes, ducts, and equipment.

E. Support devices and members shall include vibration and noise isolating devices and assemblies. Penetrations of walls to structure shall be sealed off to limit noise transmission through sleeves.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality.

B. All equipment and materials shall be installed by experienced mechanics certified and trained for the work performed.

1.4 SUBMITTALS

A. Product Data: Submit complete manufacturer's descriptive literature and installation instructions in accordance with Section 01 33 00 for all piping materials to be used for each system, valves and hydronic specialties as specified herein.

B. Shop Drawings:

1. Submit in accordance with Sections 01 33 00 and 23 05 00.
2. Submit 1/4" = 1'-0" Scale HVAC and Plumbing Piping Shop Drawings.
3. Overlay piping Shop Drawings over other Shop Drawings of other trades to include electrical and sheet metal Shop Drawings.
4. Plan views of congested areas and sections thereof shall be drawn at a scale of 3/8" = 1'-0".
5. A “Release of Liability” form must be signed after which a single electronic file uploaded to an FTP site will be produced.

C. Fully coordinate all piping shop drawings with sheet metal shop drawings and other trades. Failure to submit shop drawings in a timely manner, as required to keep pace with the construction and work of all

other trades, will result in delays, and possible stoppage, of payment to the Contractor. Additionally, no work may proceed until such shop drawings are submitted, reviewed, and found to be acceptable by the Engineer.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Storage and protection of materials shall be in accordance with Section 23 05 00.

C. Take special precautions to protect control valve internals from construction dirt and debris. If valves are stored on site cover valve openings until just prior to installation but in no case shall valves be unprotected for more than 48 hours.

D. Openings in piping system, coil headers, boilers, pumps, valves and other heat exchangers shall be covered during the construction period to protect the interior accumulation of dirt and debris in these systems until immediately prior to connection to these components to similarly protected systems.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. In general, the following listed materials shall be used in fabricating the piping systems. Where special classes of piping are involved and are not listed, the Contractor shall request instructions as to the class of material involved and the method of fabricating it before ordering the materials. Pipes 2" and smaller shall generally have screwed ends, except where special requirements dictate otherwise.

1. Refrigerant Piping: Type "ACR" hard drawn copper with 15% Silfos Solder joints. Refer to Section 23 23 00, Refrigerant Piping.
2. Condensate drain lines with Pro-Press type fittings: Type “L” hard drawn copper tubing below the roof.
3. Condensate drains from cooling coils: Type "M" or DWV (1-1/4" and larger) hard drawn copper below the roof.

B. Steel pipe shall be made and tested in accordance with the latest edition of the "Standard Specifications for Welded Steel Pipe" of the National Tube Company, or Youngstown Sheet and Tube Company. Piping 2" and smaller shall be manufactured by LeClede, Sawhill, or Wheatland. Piping 2-1/2" and larger shall be manufactured by Tex-Tube, Paragon, U.S. Steel, Wheatland or Armco. Unless otherwise specified, all pipe shall be Schedule 40 of ASA Standard B36.10.

C. In general, fittings used for the various piping systems shall be as listed below. Special fittings shall be used where required by job conditions and when approved for particular use.

1. Welding Fittings: All fittings in welded lines shall be factory fabricated welding fittings of the same material and the same schedule or weight as the piping system in which installed.

   a. All elbows, reducers, tees, caps and special fittings shall be standard factory fabricated butt welding fittings, conforming to ANSI B16.9, with the following exceptions: Branch takeoffs from lines 2-1/2" in size and larger and where the size of the takeoff does not exceed two-thirds of the nominal diameter of the mains to which connected may be made with shaped nipples or with Bonney or Grinnell Weldolets or Threadolets as required by the class of fabrication. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.
   b. Welding fittings shall be Weldbend Corporation, Tube Turn, Hackney, or approved equals. Welding and fittings shall have the same bursting pressure as pipe of the same size and schedule. All elbows shall be the long radius type unless noted otherwise.

D. Screwed Fittings in Steel Lines: 150 lb. black malleable iron banded pattern screwed fittings made by Grinnell Company, Crane Company, or Walworth Company. All screwed fitting elbows shall be the long radius type unless noted otherwise.

E. Fittings for copper tubing shall be Chase Sweat Fittings, Nibco, Elkhart, or Mueller Brass Company's "Streamline" type solder fittings. Drainage type fittings shall be used wherever possible in drainage systems only. All solder for copper tubing shall be 95-5, Silfos or Eutectic No. 180F. All piping shall be installed according to the manufacturer's instructions. All joints shall be thoroughly cleaned before connecting. Silfos solder shall be used on all refrigerant piping. All elbows shall be the long radius type unless noted otherwise.

F. Miscellaneous Fittings: Provide all reducers, increasers, adapters, bushings, etc., as required to properly inter-connect the various items, to change sizes, etc. Steel fittings shall be used in steel lines, and copper and red brass fittings shall be used in copper lines.

G. As an alternate to standard sweat fittings for copper tubing, Pro Press type fittings shall be allowed for all drain lines as follows:

1. 3" and smaller, wrought copper. Press fittings, or ASME 16.2.2, ASME 15.18 sealing with EPDM sealing element for ½" to 2" and ProPress XL for 2-1/2" to 3.
2. Contractor shall provide Owner at completion of project one (1) complete set (½" to 3") of new actuators and jaws.

H. **All piping materials and fittings shall be manufactured in the United States**.

2.2 FLANGES

A. Flanges in copper lines shall be solder joint type cast brass flanges.

B. Flange bolts and nuts shall conform to the applicable requirements of the latest edition of the Code for Pressure Piping.

C. Slip-on welding neck flanges are prohibited.

D. Flanges shall be Weldbend, Tube Turn, Hackney, or approved equals.

2.3 GASKETS

A. Install gaskets between flanges of all flanged joints. Where used with brass or bronze flanges or with flat face ferrous flanges, they shall be full face type. For all other flanges they shall be ring gaskets properly cut to fit within the inside edges of the bolts.

B. Gaskets in water lines shall be Garlock No. 24 Wire Insertion Red Rubber Sheet Packing, 1/16" thick and for any other systems use special materials suitable for the duty as recommended by their manufacturer.

2.4 INSULATING FITTINGS

A. Except that no dielectric fitting shall be installed in connections between copper or brass and sanitary cast iron waste, drain and vent lines, wherever an interconnection is made between ferrous pipes or vessel and copper tubing or brass pipe, or vice versa, install a dielectric fitting.

B. In lines assembled with screwed or soldered joints, use insulating couplings (unions) suitable for the intended service and where flanged connections are required, use insulating gasket material between flange faces, insulating grommets between bolts and holes in flanges and insulating washers under both bolt heads and nuts.

C. PVC couplings of any kind shall not be acceptable for insulating couplings.

D. Insulating fittings shall be suitable for the service medium, operating pressure and temperature. Fittings shall be rated for 1.5 times the normal system operating temperature and pressure in which installed.

E. Insulating fittings shall be as manufactured by EPCO, Watts, Zurn or Mueller Streamline.

2.5 PIPE HANGERS

A. Pipe hangers, except for fire protection types, shall be as manufactured by Anvil International, Inc. and be of a type suitable for each use. Approved equals by Mason Industries, Inc., B-Line, Erico Caddy, and PHD Manufacturing, Inc. will be considered.

B. Where several pipes are routed parallel to each other and at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where rollers are called for elsewhere by these specifications.

C. For bare copper pipes (uninsulated only) up to and including three inches (3") in size, use Anvil Fig. CT-109 malleable iron, copper plated, split ring, hangers or Anvil Fig. CT-65 copper plated clevis hangers. For uninsulated copper pipes larger than three inches (3"), use Anvil Fig. CT-65 copper-plated clevis hanger.

D. Hanger rod sizes shall conform to the following schedule:

Pipe up to, and including 2"	3/8" rods
Pipe 2-1/2", 3", and 3-1/2"	1/2" rods
Pipe 4" and 5"	5/8" rods
Pipe 6"	3/4" rods
Pipe 8", 10" and 12"	7/8" rods
Pipe 14", 16" and 18"	1" rods
Pipe 20" up to 30"	1-1/2" rods

E. Unless shown otherwise on the Drawings, all horizontal runs of copper piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following maximum spacing:

Pipe up to 3/4" in size	6 feet
Pipe 1" and 1-1/4"	8 feet
Pipe 1-1/2" and 2"	10 feet
Pipe 2-1/2" and larger	12 feet

F. There shall be a hanger within two feet (2') of each elbow or tee. Vertical risers shall be supported by approved riser clamps. Vertical pipes within a space shall have not less than two (2) supports. Where the vertical run of pipe in a space exceeds 14 feet then three (3) supports shall be required.

G. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting; nor shall it be supported from equipment connections.

H. Inserts shall be used where piping or equipment is to be hung from concrete construction. Inserts shall be Anvil Fig. 281, wedge type, concrete inserts. All inserts shall be pre-treated to prevent rusting. After the forms are removed, clip off all nails flush with the exposed surface of the inserts.

I. Expansion bolts shall be Ackerman-Johnson.

J. Beam clamps suitable for the use with the type of steel construction involved shall be an Anvil product or an approved equal as indicated elsewhere herein.

K. No perforated straps shall be used to support any mechanical equipment item or piping of any kind.

L. domestic cold water, domestic hot water (includes recirculated lines), condensate drains, horizontal and vertical storm drain downspouts and soil piping receiving cold condensate piping hangers shall be sized to go around the insulation with shields being provided to protect the insulation. Shields shall be Anvil Fig. 167.

M. All steel hangers, base plates, supports, nuts, bolts, and all thread rod located outdoors, in crawl spaces, and exposed to the weather, shall be made of galvanized steel or equally suitable corrosion resistant steel alloy or aluminum. Where steel components are allowed and used under these conditions they shall be painted with an equivalent protective coating similar to a two-part epoxy. Refer to Section 09 90 00.

N. For pipe sizes 8" and under use Anvil Fig. #93 and 94 beam clamps. For pipe sizes 10" through 18" use Anvil Fig. #66 in the “U” position.

2.6 SLEEVES AND ESCUTCHEONS

A. Generally where pipes pass through interior building walls or floors above the first floor (out of the ground), 22 gauge galvanized sheet metal sleeves shall be used. Sleeves shall extend a minimum one inch (1") above a floor or beyond the wall, as applicable.

B. All pipes penetrating grade beams, exterior walls, concrete structural members, or concrete slabs of mechanical equipment rooms on the first floor shall generally use standard weight galvanized steel pipe as the sleeving material.

C. For concrete or masonry walls, sleeves shall be inserted into the masonry, decking or form work prior to the pouring or placement of concrete or masonry units to create a leave out.

D. The sizes of all sleeves shall be such as to permit the subsequent insertion of the intended pipe of the proper size with adequate clearance for movement due to expansion and contraction. In the case of insulated lines, the diameter of the sleeves shall be at least 1/2" greater than the outside walls of the pipe with specified thickness of insulation. This will require that the inside diameter of galvanized steel pipe sleeves be at least 1/2" greater than the outside diameter of the service pipe with insulation. Galvanized steel pipe sleeves set in floors shall project two inches (2") above the floor.

E. After the pipes are installed, fill the annular space between the pipe, and insulation as required, and its sleeve with an approved mastic or caulk. Use loose fibrous insulation packing as required to accomplish this. In all cases the annular spaces around the pipes within the sleeved openings shall be filled with loose fibrous insulation and then sealed with an approved caulking or expanded foam insulation.

F. Escutcheons, except as specifically noted or specified, shall be installed on all pipes passing exposed through floors, walls, or ceilings. Escutcheons shall be equal to the Crane No. 10, chrome plated sectional floor and ceiling plates, and shall fit snugly and neatly around pipe or pipe insulation or insulated lines. Solid chrome plates with set screws shall be used if sectional plates do not fit properly or stay in place. Where multiple pipes penetrate floors or walls in close proximity in concealed areas, shop made sheet metal escutcheons may be used.

G. Pipes sleeved through grade beams open to basements, crawl spaces or void spaces below grade shall additionally receive "Link Seal" or equal closures made of interlocking synthetic rubber links. Seals shall provide for absolute water tightness. Seal shall be constructed to insulate electrically pipe from wall. Install as recommended by manufacturer. Provide Century-Line sleeves with water stop and anchor collar for pipes penetrating grade beams designated to be anchored.

H. Where PVC pipes, 3 inches and smaller, and small copper water piping under 2 inches in size, penetrated a horizontal floor slab a metal sleeve will not be required. For these piping systems, completely wrap the piping with a polyethylene tape, or wrapping. This tape shall be minimum 4 mils thick and shall be wrapped at least two times around the pipe and secured sufficiently to hold the wrap in place during the pouring of the slab. This wrap shall be in sufficient length or height to insure that no concrete will be in contact with the pipe. All other piping shall be sleeved as indicated elsewhere herein.

I. Refer to Section 23 05 00 for additional requirements of penetrations through fire-rated assemblies.

PART 3 - EXECUTION

3.1 PIPING - GENERAL

A. Where special classes of piping are involved and are not listed, the Contractor shall request instructions from the Owner's Representative as to the class of material involved and the method of fabricating it before ordering any material. All steel lines 2-1/2" and larger shall be assembled by welding. All steel lines 2" and smaller may be assembled either by welding or by screwed fittings as specified.

B. Welding shall be done by mechanics who satisfy qualification requirements of the American Welding Society. The pipe ends to be welded shall be machine beveled wherever possible. Gas cuts shall be true and free from all burned metal. Before welding, surfaces shall be thoroughly cleaned. The piping shall be carefully aligned and no metal shall project within the pipe. Fully ream, to the full inside pipe diameter dimensions, the inside of all piping to be welded. Miter joints will not be allowed in any case. All headers, connections, elbows, reducers, flanges, and special flanges and special fittings shall be made using forged steel welding fittings of the same weight as the pipe to which they are attached. All unions and connections to valves 2-1/2" and larger shall be made by the use of welded flanges.

C. Branches in lines where the branch side is equal to 2/3 of the size of the main or smaller may be connected by using Weldolets or Threadolets; where the sizes are greater than 2/3 of the main, standard weight seamless tees as manufactured by Tube-Turns or Grinnell, A.S.T.M. Standard A-234 shall be used.

D. The location, direction, and size of all lines are generally indicated on the drawings. Branch connections in general are indicated and shall be so installed as to provide proper grades.

E. All lines shall be made up straight and true at proper grades. All water filled and condensate drain lines shall grade down to drains.

F. Piping shall follow as closely as possible the routes shown on the plans and take into consideration conditions to be met at the site. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after proper approval has been obtained.

G. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which the lines are connected.

H. All headers shall be assembled as indicated using welding fittings throughout.

I. All screw joints shall be made with taper threads, properly cut. Joints shall be made tight with graphite and oil applied to the pipe threads only and not to the fittings.

J. Dielectric couplings shall be installed where ferrous pipe joins copper lines and shall be rated for the intended medium pressure and temperature or service.

K. Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of systems. No unions will be required in welded lines or lines assembled with solder joint fittings except at equipment items or coils, machinery items and other special pieces of apparatus. Unions in 2" and smaller lines shall be ground joint and unions 2-1/2" and larger shall be flanged unions. Unions shall be the same material and strength as other fittings in the lines. Companion flanges on lines at various items of equipment, machines, and pieces of apparatus shall serve as unions to permit removal of the particular item.

L. All piping shall be supported by hangers independently of equipment connections. The weight of the piping and it's contents shall not be imposed on the equipment in any way.

M. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

N. Swing joints or expansion loops shall be provided wherever shown on the Drawings or wherever else necessary to allow for the expansion and contraction of piping. This shall be accomplished in an approved manner and this Contractor shall be responsible for any damage which may occur as a result of expansion and contraction of his piping.

O. Nipples shall be of the same size and material as the piping in the system in which the nipples are installed, except that "close", or "all thread" nipples shall not be used.

P. Keep all open ends of piping in each system plugged or capped to prevent dirt or other debris from entering the pipe at any and all times during construction and before fixtures or equipment is connected. All piping shall be flushed clear prior to connection to the central building systems.

Q. The ends of all piping furnished and installed in all systems shall be thoroughly reamed to the full inside diameter of the respective pipe.

R. Exposed and concealed lines shall be run parallel with, and perpendicular to building lines and wherever possible shall be grouped together for easy service and identification. Whenever possible, horizontal and vertical runs shall be held as close as possible to the walls, ceilings, struts, members, etc., so as to occupy the minimum space consistent with the proper installation requirements for insulation, conduit, ductwork, lighting fixtures, etc., and the expansion requirements of each of these items and the building proper or the removal of the respective or adjacent pipes, conduits, and ductwork, and to allow for necessary access to valves, other pipes, conduits, dampers, etc.

3.2 CROSS CONNECTION AND INTERCONNECTIONS

A. No plumbing fixtures, device, or piping shall be installed which will provide a cross connection or interconnection between a distributing water supply for drinking or domestic purposes and a polluted supply such as drainage system, or a soil or waste pipe which will permit or make possible the backflow of sewage, polluted water, or waste into the water supply system.

3.3 EXCAVATION AND BACKFILLING

A. Provide necessary excavating and backfilling for the installation of work specified in this Division as specified in Section 23 05 00 and 31 23 00.

3.4 FLASHINGS

A. Flash around all pipes passing through the roof with sheet lead, as specified in Section 07 52 50, built a minimum of 10" into the roofing, in all directions from the outside of the pipe running up the pipe a minimum of 10" and more where vent terminals must be higher to conform to the requirements of the local

Plumbing Code in effect, and then turned over one inch (1") into the pipe cavity. All seams and joints shall be completely soldered closed and the entire flashing shall be completely waterproof.

B. Make all roof penetrations in accordance with the roofing system manufacturers approved methods and as specified in Section 07 62 00.

3.5 PIPE INSULATION INSERTS AND SHIELDS

A. Provide a section of Foamglas insulation, calcium silicate, or urethane of thickness specified at hanger support locations and provide No. 16 gauge galvanized steel protection shield minimum 12" long. Shield shall be full half cylinders equal to Grinnell Fig. 167.

B. Refer to Section 23 07 00, Insulation.

3.6 SAFETY GUARDS

A. Furnish and install all safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction.

B. All belt driven equipment, projecting shafts and other rotating parts shall be enclosed or adequately guarded.

3.7 TESTING AND REPAIRING

A. During the progress of each portion of the work or upon its completion, make such tests of this work as herein specified, or as required by the Architect, or by State or Municipal Bureaus having jurisdiction and under their supervision.

B. Provide all apparatus, temporary piping connections, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building and its contents incurred by such tests as will be required to repair and make good, at no cost to the Owner, any damage so caused. Testing of piping to be insulated shall be done before insulation is applied.

C. Perform any other tests as may be required by the Owner's Representative to indicate the fulfillment of specification requirements.

D. All water piping shall be hydrostatically tested to a pressure of 150 psig or to 1-1/2 times the operating pressure, whichever is the greatest, for six (6) hours.

E. Domestic hot and cold water piping shall be tested at 1.5 times the operating pressure or 150 PSIG, whichever is greater, for six (6) hours. Any leaks developed shall be made tight and the test repeated. Test pressure shall not be applied to specialties, but joint shall be tested for leaks at operating pressure when complete.

F. Waste and vent piping shall be tested at completion of the rough work and before fixtures and traps are connected. Openings, except tops of bends, are to be plugged and the system completely filled with water. System shall stand without leak or loss of water for a period of not less than four (4) hours.

G. Systems shall be tested in portions as required by the construction schedule and the portions being tested shall be effectively isolated and sealed off. When previously tested sections are connected into other sections, tests shall be rerun to include the new connections.

H. Partial systems shall be tested prior to connecting into existing lines.

I. Leaks in screwed joints shall be repaired by tightening the joint until the leak has stopped, or by remaking the joint if tightening fails to stop the leak. Leaks in welded joints shall be repaired by chipping out the weld around the leak and rewelding until it is stopped. Leaks in caulked joints shall be completely stopped by additional caulking of the joint, but, if that fails, the joint shall be re-made. A leak in a compression joint shall be repaired by remaking the joint using a new seal, compression ring, coupling, etc., as required. Leaks in soldered joints shall be repaired by remaking the joint and no soldering or brazing over existing joints will be permitted. Any defective piping shall be replaced.

J. Additional testing shall be as specified in the individual Sections of these Specifications.

K. During testing and cleaning of piping systems, use a fine mesh, 20 mesh or smaller, start-up strainer screen for all strainer pipe sizes. After piping system is cleaned each strainer shall be taken apart, cleaned, and final strainer mesh shall be placed back in strainer for normal operating conditions.

3.8 SEALING PENETRATIONS

A. Seal all pipe and duct penetrations through walls run to structure, ceilings, floors and roofs. Fill the annular space between the insulation on the pipe, or the pipe only where uninsulated, or duct and its sleeve, with neoprene or non-hardening sealant.

B. No pipe or duct shall be allowed to contact its surrounding sleeve or the wall, floor, or ceiling. Effective isolation shall be provided as described in Section 23 05 48 to the end that no vibration or direct noise transmission shall be transmitted. Vibration transmission limits shall be as established in Section 23 05 48. Use special materials as may be required to comply.

C. Firestop pipe and duct floor and wall penetrations as specified in Section 07 84 00 and 23 05 00.

3.9 PAINTING

A. All equipment specified in Division 23 shall be delivered to the site with suitable factory finishes as specified elsewhere herein.

B. Items with factory applied finishes shall be protected during installation and other construction work. Damaged factory applied finishes shall be refinished to match the original finish appearance.

C. Field painting of items specified and installed in Division 23 shall be as specified in Section 09 90 00.

D. All ferrous metals that are not galvanized or made of a corrosion resistant alloy shall be painted. This shall include steel pipe hangars, trapeze supports, pipe stands, all thread hangar rods and other miscellaneous systems.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections, as applicable. Refer to other divisions for coordination of work with other portions of Work.

1.2 SYSTEM DESCRIPTION

A. Furnish and install all refrigerant piping of every kind required, specified, or shown on the Drawings for the installation of the work specified in Division 23. The location, direction, and size of the various lines are indicated on the Drawings. Lines for pilot and controls and instrumentation are not shown but shall be installed as required and as specified.

B. Piping systems shall include all appurtenances shown on the drawings and specified herein.

C. Valves or cocks shall be installed to control the flow of refrigerant to each of the various systems, to segregate individual items of equipment, and to permit ease of installation and servicing as directed on the Drawings and specified.

D. The work shall include the furnishing and installing of all supporting structures and members for pipes and equipment.

E. Support devices and members shall include vibration and noise isolating devices and assemblies. Penetrations of walls to structure shall be sealed off to limit noise transmission through sleeves.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality.

B. All equipment and materials shall be installed by experienced mechanics certified and trained for the work performed.

1.4 SUBMITTALS

A. Product Data: Submit complete manufacturer's descriptive literature and installation instructions in accordance with Section 01 33 00 for all piping materials to be used for each system, valves and refrigerant specialties as specified herein.

B. Shop Drawings: Submit in accordance with Sections 01 33 00 and 23 05 00. Submit 1/4" = 1'-0" Scale Refrigerant Piping Shop Drawings. These shop drawings may be inclusive with other piping or ductwork shop drawings.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during construction shall and will be rejected.

B. Storage and protection of materials shall be in accordance with Section 23 05 00.

C. Take special precautions to piping and special internals from construction dirt and debris. If valves are stored on site cover valve openings until just prior to installation but in no case shall valves be unprotected for more than 48 hours.

D. Openings in piping system, coil headers, valves and other heat exchangers shall be covered during the construction period to protect the interior accumulation of dirt and debris in these systems until immediately prior to connection to these components to similarly protected systems.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. In general, the materials indicated herein shall be used in fabricating the refrigerant piping systems. Where special classes of piping are involved and are not indicated, the Contractor shall request instructions as to the class of material involved and the method of fabricating it before ordering the materials.

B. Piping shall be Type L, ACR hard copper (soft copper line set tubing is not acceptable). All fittings shall be long radius elbows and standard tees.

C. Only "Silfos" solder joints shall be used for fitting fabrication.

D. Miscellaneous Lines: Pilot, bleed, control, sampling, and equalizing lines, and similar auxiliary lines shall be fabricated of the material used in the system to which they are connected in each case.

E. Miscellaneous Fittings: Provide all reducers, increasers, adapters, bushings, etc., as required to properly inter-connect the various items, to change sizes, etc. Copper and red brass fittings shall be used in copper lines.

F. Fittings for copper tubing shall be Chase Sweat Fittings or Mueller Brass Company's "Streamline" solder fittings. All piping shall be installed according to the manufacturer's instructions. All joints shall be thoroughly cleaned before connecting. Silfos solder shall be used on all refrigerant piping.

PART 3 - EXECUTION

3.1 DELIVERY AND PROTECTION

A. Deliver all piping and appurtenances to each site. All components shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt. All items shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces. Rejected items shall be replaced promptly at no cost.

B. During construction, take all steps necessary to protect piping and accessories from damage or vandalism. All damage or vandalism shall be repaired at no cost to the Owner.

3.2 CONDENSING UNIT INSTALLATION

A. Install condensing units level on roof supports where shown with vibration isolation as specified in Section 23 05 48.

B. Route refrigerant piping and make connections to DX coils as recommended by the unit manufacturer and as required to meet the capacity control requirements specified.

C. Furnish and install, if not specified to be factory assembled, all refrigerant piping specialties including, but not limited to, thermal expansion valves, sight glasses, solenoid valves, accumulators, hot gas bypass components, hot gas mufflers, and filter dryers.

D. Charge all refrigerant piping systems and equipment to maintain a fully operating refrigerant charge.

E. Pipe refrigerant relief piping to the outdoors or as otherwise required by the local authorities having jurisdiction and the manufacturer.

3.3 REFRIGERATION PIPING

A. Piping shall be Type "L" copper. ACR cleaned and capped. All fittings shall be cleaned and degreased before use.

B. Flow inert gases such as dry nitrogen through the piping while heating pipe or fittings for joining. Install liquid line drier and sight glass near condensing unit.

C. Leak testings: After the system is installed and before any piping is insulated. The entire refrigeration circuits must be thoroughly leak tested. The following test procedure is recommended:

1. Remove and plug the connection points of any controls or relief valves that could be damaged by test pressure.
2. Connect a cylinder of oil-pumped, dry nitrogen to the front seat port of the compressor discharge valve or at the liquid line charging valve.
3. Test at 150 psig or the leak test pressure specified by local code.
4. Tap each solder connection sufficiently hard to start any leak that might subsequently open from thermal expansion and contraction or vibration.
5. Test all pipe joints for leaks. Brush each connection with a soap solution and watch for bubbles.
6. After leak test, charge enough refrigerant through the liquid line charging valve to raise the system pressure to approximately 10 psig. Remove the refrigerant connection and charge enough nitrogen into the system to raise the test pressure to 150 psig or the local code requirement.
7. Check all parts of the system with a halide torch, or electronic leak detector.

D. Evacuation:

1. Connect the vacuum pump to as many points of the system as possible. Vacuum gauge, a Zimmerli Gauge, or an electronic vacuum gauge, shall be connected to the liquid line charging valve. Open compressor valves. Open the liquid line charging valve.
2. Operate vacuum pump until a vacuum equivalent to 500 microns is registered by the vacuum gauge.
3. When the system has been evacuated, charge enough oil-pumped dry nitrogen into the system to raise the pressure to atmospheric. Re-evacuate the system.
4. After the 500 micron vacuum reading has been re-established, stop the system and allow it to stand under vacuum for a minimum of 12 hours. If the vacuum reading remains unchanged, the system is ready to receive its charge of refrigerant.

E. Charging:

1. Charge the system with new, clean oil and refrigerant of the proper type.
2. Charge until the sight glass is bubble free.
3. Check charge level after system has operated for 24 hours in warm weather. Add oil and refrigerant as needed under these conditions.

END OF SECTION

SECTION 23 30 00

HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.2 SYSTEM DESCRIPTION

A. The scope shall include the furnishing and installation of all ductwork as shown on the Drawings; acoustical and thermal linings; flexible ducts and connections; combination smoke and fire dampers, smoke dampers, and fire dampers; duct access doors; fabric duct, air diffusers, grilles and registers; air volume control devices; hangers and supports; plenums and casings; turning vanes; air filters; installation of temperature control dampers, and other appurtenances necessary for a complete and operational system.

B. All work shall be preceded by taking measurements at the job site, fully coordinating all work with other trades, verifying available spaces for ductwork, and developing Shop Drawings illustrating such.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the quality as specified herein. All work shall comply with the most recent Local Building Code, Mechanical Code, Fire Code, and all other applicable National, State and Local Codes or ordinances.

B. All equipment and materials shall be installed in a workmanlike manner by trained and experienced sheet metal technicians and mechanics as recommended by the manufacturers of the products installed.

C. Building Codes and Standards:

1. Where the standards and requirements of this specification exceed those of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) the requirements herein shall govern. As a minimum all ductwork shall be constructed to meet all functional criteria defined in Section 11 of the 2005 SMACNA “HVAC Duct Construction Standards, Metal and Flexible,” Third Edition. However, all ductwork shall comply with all code requirements noted above to include meeting deflection limits established in the local Mechanical code.
2. Fabric duct must be Classified by Underwriter’s Laboratories in accordance with the 25/50 flame spread/smoke developed requirements of NFPA 90-A and UL 2518. Also Classified by UL-C (Canada) S102.2, BS 5867 Part 2, 1980; GB8624-2006.
3. All product sections associated with fabric duct must be labeled with the logo and classification marking of Underwriter’s Laboratories.

D. The work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job, "Substantial Completion", against noise, chatter, whistling, or vibration, and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner's Representative.

E. Air quantities shown on the Drawings, or specified, are based on air at 75 Deg.F. dry bulb, 50 percent relative humidity, and 29.92 inches H.G. barometric pressure.

F. Except where specified otherwise, all sheet metal used shall be constructed from prime galvanized steel sheets or coils up to 60 inches in width. Each sheet shall be stenciled with manufacturer's name and gauge. Coils of sheet steel shall be stenciled throughout on 10 foot centers (fabricate with stencils to the outside of the ductwork so they are visible when installed) with manufacturer's name and gauge tolerances in inches:

Gauge No.	Nominal Thickness	Minimum Thickness
26	0.0217	0.0187
24	0.0276	0.0236
22	0.0336	0.0296
20	0.0396	0.0356
18	0.0516	0.0466

G. Contractor shall comply with this specification section in its entirety. If during a field observation, the engineer of record finds changes have been made without prior written approval, the contractor shall make the applicable changes to comply with this specification at the contractor's expense.

H. At the discretion of the Engineer of Record, sheet metal gauges and reinforcing may be randomly checked to verify all duct construction is in compliance with this is specification section.

I. All ductwork and fittings shall have a computer generated label affixed to each section detailing all applicable information including the duct dimensions, gage, reinforcement type/class, and connector type of the systems manufacturer. In addition, galvanizing thickness and country of origin shall be clearly stenciled on each duct section.

J. Design & Quality Control:

1. For fabric duct, manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions in all items specified herein in accordance with Section 23 05 00.

B. Shop Drawings shall be submitted on all items of sheet metal work specified herein. Shop drawings of ductwork shall be submitted at a minimum scale of 1/4" equal to one foot except that the Congested Areas and all Air Handling Unit Mechanical Rooms shall be submitted at a minimum scale of 1/2" = 1'-0". Provide sections for all Congested Areas and Mechanical Room Plans.

C. Shop Drawings shall include the reflected ceiling plan, screened back, overlaid onto the floor plan indicating the proposed installation of all light fixtures; ductwork layout; duct fittings; duct connection details; offsets; bottom of duct elevations; all sheet metal dimensions (sizes); overall air device sizes, air device neck sizes, air device air flow quantities, and device type; duct pressure classifications; all mechanical piping; any conflicts discovered and unresolved through the use of transitions and offsets in the available space; turning vanes; manual volume dampers; automatic control dampers; smoke and fire dampers; duct access doors; flexible connections; and all mechanical fans and equipment.

D. Sheet metal shop drawings shall be overlaid on piping shop drawings and other shop drawings for other portions of work specified in other sections of these specifications for complete coordination of all work prior to commencing with any installation. These Shop Drawings shall not be prepared directly on the

Shop Drawings of other trades; they will be separate from all other shop drawings. Coordination Drawings shall be prepared in accordance with Specification Sections 01 33 23.

E. Shop Drawings shall be based on actual field measurements taken at the job site and shall take into consideration all obstacles and be fully coordinated with all piping, conduits, structure, equipment, and general construction features.

F. Shop Drawings shall be generated by a computer aided design and drafting (CADD) system as a CADD drawing. CADD files with Architectural Backgrounds and Mechanical design drawing files will only be provided when requested, if this privilege has not been previously abused, after a Release of Liability Form has been completed.

G. Include a brochure, with individually assembled cut sheets, and details of all sheet metal fittings, duct construction standards proposed for each system, air volume control devices, and other accessories proposed to be used for job duct construction standards. This shall be done prior to submission or preparation of any sheet metal shop drawings.

H. Should any ductwork installation commence without approved ductwork shop drawings or written approval by the Engineer of Record, the Contractor assumes all liability, to include all costs, in revising any portion of the sheet metal work that is deemed unacceptable by the Owner's Representative to include any conflicts discovered in installation that could have been resolved through the Shop Drawing process.

I. Provide detailed drawings confirming configuration of Fabric Tensioning System (components, support locations, segment lengths) and Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).

J. Provide detailed installation instructions for components to be installed.

1.5 GUARANTEE

A. The work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job, “Substantial Completion”, against noise, chatter, whistling, or vibration, and be free from pulsation under all conditions of operation. This guarantee shall include defects in material, equipment and workmanship.

B. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner’s Representative. This shall include repair of damages to building materials related to these deficiencies.

C. Manufacturer must provide a 15 Year Product Warranty for products supplied for the fabric duct portion of the system.

1.6 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored, which has been damaged or defaced, or which has gotten wet during storage or construction shall be rejected.

B. Prior to ductwork being installed the roof system, or floor above the ductwork, must be sufficiently installed to protect ductwork from rain water entering ductwork. If the building is not dried-in and walls, windows, etc., are not completed, then cover all openings in ducts with securely fastened heavy duty, minimum three (3) mil thick, plastic to protect from rain damage.

C. Storage and protection of materials shall be in accordance with Section 23 05 00.

D. Protect textile air dispersion system and SkeleCore FTS components from damage during shipping, storage, and handling.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. General:

1. All ductwork shown on the Drawings, specified or required for the heating, ventilating, and air conditioning systems, shall be constructed and erected in a first-class workmanlike manner by trained and skilled sheet metal workers.
2. All ducts shall be erected in the general locations shown on the Drawings, but must conform to all structural and finish conditions of the building. Before fabricating any ductwork, Contractor shall check the physical conditions of the job site, and shall make all necessary changes in cross sections, offsets, etc., whether they are specifically indicated or not.
3. Before starting shop drawings or fabrication of any ductwork, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, tile patterns, etc.
4. The sizes of ducts indicated on the Drawings are the required net internal air stream dimensions, and where ducts are lined, the sheet metal sizes shall be increased three inches (3") in both dimensions to accommodate the linings (1-1/2" thick lining, unless indicated otherwise). Assume all rectangular ducts are lined unless noted otherwise.
5. Ductwork shall be classified, for construction standards, as follows:

    a. All ductwork for constant volume air handling equipment are operating at pressures up to two inches (2") W.G., classified as low pressure ductwork, and shall be constructed to two inch (2") W.G. standards.
    b. All exhaust ductwork, except grease or other special exhaust systems specified elsewhere herein, all constant volume ductwork (supply and return) served by packaged rooftop units, split direct expansion (supply, return and outside air) A/C units, and all transfer air ducts shall be constructed to meet one inch (1") W.G. standards.

6. Except as noted otherwise, ducts, plenums, and casings shall be constructed of new lock forming quality galvanized prime grade steel sheets. The gauges of metal to be used, duct construction details, and the construction and bracing of joints shall be in accordance with the latest edition of the published standards of the ASHRAE Handbook or in accordance with the latest editions of Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) "Duct Construction Standards Manual, Metal and Flexible".
7. Plenum chambers shall be constructed of 18 gauge sheets thoroughly braced with 1-1/2 inch angle irons. All duct panels in rectangular galvanized steel ducts which are 12 inches and wider and which are not lined shall be cross broken.
8. Make square elbows where shown or required, with factory fabricated double thickness turning vanes. Job fabricated vanes will not be acceptable. Except as otherwise specified or indicated on the drawings, make all other changes in direction with rounded elbows having a centerline radius equal to 1-1/2 times the width of the duct in the plane of the bend.
9. Make transformations in duct shape or dimension with gradual slopes on all sides. Normally, make increases in dimension in the direction of air flow, with a maximum slope of one inch (1") in seven inches (7") on any side. Where conditions prevent the normal slope specified above, a maximum slope of one inch (1") in four inches (4") will be allowed only where conditions necessitate.
10. Where a transition must be made with less slope than that noted above, install single thickness guide vanes to insure proper air flow, and to minimize air pressure drop. Transitions that require less slope than that noted above shall be noted on Shop Drawings, and require review and approval by the Engineer prior to installation.
11. Ducts shall be routed in conjunction with all types of pipes, electrical conduits, ceiling hangers, etc., so as to avoid interferences insofar as possible. When duct penetrations are unavoidable, provide streamline-shaped sleeves around such material penetrations, made airtight at duct surfaces, except that such sleeves are not required at tie rods. When the Contractor believes such penetrations are unavoidable, notify the Owner's Representative for approval prior to commencing with such work. Otherwise all such penetrations are not expected to occur and are not allowed. Such penetrations will not be allowed for the convenience of, or lack of coordination by, the Contractor. Where obstructions necessitate, are approved by the Owner's Representative, and are of a size exceeding 10% of the total duct area, the duct shall be transformed to maintain the same original duct area.

12. Where each duct passes through a fan room wall, it shall be wrapped with not less than 1/2" thick closed cell neoprene tightly fitted to the outer surface of the duct all around and sealed. In lieu of this method, completely fill the annular space between the duct and penetration by packing with fibrous insulation and seal the perimeter of the penetration around the duct, on both sides of the penetration, with a flexible non-hardening sealant, to be fire rated when applicable.
13. All outlets or grilles in ceilings shall be supported rigidly from ceiling construction with suitable adapters or bucks installed as necessary and as shown to insure outlets and grilles will be accurately trued up with ceiling.
14. Ductwork shall be fabricated in a manner to prevent the seam or joints being cut for the installation of grilles or diffusers.
15. All sheet metal ductwork shall be securely hung from the building construction. All ducts shall be hung adjacent to the seam in the duct and shall be secured in a suitable manner to both the duct and the building construction. All vertical riser ducts shall be supported at each floor with angle iron secured to the ducts and set on the structure members. These angles shall be the same size as specified for bracing.
16. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched), and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time. All panels of uninsulated ducts twelve inches (12") and larger shall be cross broken. In general, sheet metal screws shall not be used in duct construction unless the point of the screw is in the air stream unless specifically indicated otherwise elsewhere herein.
17. Manual dampers shall be installed as shown on the Drawings and as required to afford complete control of the air flow in the various duct systems. In rectangular supply ducts, a splitter damper shall be installed at each point where a branch is taken off and additional volume dampers shall be installed where shown or required to achieve the final air balance. No splitter dampers shall be installed in medium pressure ductwork, unless specifically shown on Drawings.
18. Splitter dampers and volume dampers of the "butterfly" type, installed in rectangular ducts, shall be constructed of 16 gauge galvanized steel riveted or welded to square operating rods. Dampers shall have brass, bronze, or approved plastic bearings. The length of any splitter damper blade shall be 1-1/2 times the width of the smaller split in the duct, but shall be not less than twelve inches (12"). Where splitter dampers exceed 12 inches in height two (2) pull rods shall be used. Splitter dampers 12 inches (12") in height or less shall have one (1) pull rod.
19. Butterfly damper blades in round ducts shall be the full width of the duct in which they are installed. Dampers shall be constructed of a minimum 22 gauge metal. Dampers over twelve inches (12") in diameter shall be constructed of 20 gauge metal, have a continuous rod with end bearings opposite the damper handle, and a quadrant type locking handle.
20. The operating rods of all dampers shall be fitted with Young Regulators and the operating head shall be securely fastened in place so as to be accessible in the finished building unless shown otherwise. Operators shall be attached to duct where regulator occurs above a lay-in ceiling. Use a Ventlok No. 555 locking quadrant on accessible concealed splitter dampers. Where locking quadrants are installed on externally insulated ductwork a hat channel extension shall be used to match the same height as the insulation thickness. Where dampers occur above or behind plaster or other inaccessible ceilings, walls, chases or furrings, the regulator shall be the concealed type with adjustable cover plate equal to Young Regulator Company Type 315 with maximum 2-1/2" diameter cover plate and required accessories. Young Regulator bearings shall also be provided on the opposite end of each operating rod.
21. Behind each ceiling supply outlet, provide and install a turning vane or approved equalizing grid, where noted or scheduled. Where adjustable air pick-ups are indicated at points branch ducts meet trunk ducts, they shall be Titus AG-45 or approved equal with operator adjustable from the duct exterior.
22. Rectangular opposed blade volume dampers shall be as manufactured by American Warming and Ventilating or Ruskin. Blades shall not exceed 48 inches in length or twelve inches (12") in width, and shall be the opposed interlocking blade type. The blades shall be of not less than No. 16 gauge steel supported on one-half inch (1/2") diameter rustproofed axles. Axle bearings shall be the self-lubricating ferrule type.

B. Low Pressure Ductwork:

1. Rectangular low pressure ducts, systems designated to be operating at up to two (2) inches W.G., shall be constructed of the following medium gauges:

Largest Dimension of Duct	U.S. Gauge of Metal	Maximum Reinforcement Spacing
Up to 26"	26	5'-0"
27" to 42"	24	4'-0"
43" to 48"	22	4'-0"
49" to 60"	20	4'-0"
61" to 84"	18	4'-0"
85" to 96"	18	3'-0"
97" and Over	18	2'-6"

The above rectangular ducts shall be constructed in accordance with Section 1 the latest edition of the "Duct Manual" published by the Sheet Metal and Air Conditioning Contractors National Association. However, the gauge thickness of the ductwork shall meet that as scheduled above.

2. Rectangular low pressure ducts, for systems designated to be operating at up to one (1) inches W.G., shall be constructed of the following medium gauges:

Largest Dimension of Duct	U.S. Gauge of Metal	Maximum Reinforcement Spacing
Up to 36"	26	5'-0"
37" to 48"	24	5'-0"
49" to 60"	24	4'-0"
61" to 72"	22	4'-0"
73" to 84"	20	4'-0"
85" to 96"	18	4'-0"
Over 96"	18	2'-6"

The above rectangular ducts shall be constructed in accordance with Section 1 the latest edition of the "Duct Manual" published by the Sheet Metal and Air Conditioning Contractors National Association. However, the gauge thickness of the ductwork shall meet that as scheduled above.

3. Round low pressure ducts shall be spiral wound as manufactured by United Sheet Metal Company or have grooved seams with flat snaplock longitudinal seams. Spiral seam round duct gauge thicknesses shall be that standard by the manufacturer for the pressure rating of the system. Gauges for snaplock shop fabricated ducts shall be as follows, without exception:

Largest Dimension of Duct	Gauge of Metal	Gauge of Longitudinal Seams and Fittings
Up thru 8" in Diameter	26	26
9" to 14"	26	24
15" to 26"	24	22
27" to 36"	22	20
37" to 50"	20	18
51" to 60"	18	16

Elbows shall have a centerline radius of 1-1/2 times duct diameter or width and for round ducts may be smooth elbows or 5 piece 90 degree elbows and 3 piece 45 degree elbows. Joints of round ducts shall be slip type with a minimum of three (3) sheet metal screws.

4. All low pressure ductwork shall be externally sealed using water based products to include, United McGill Corporation United Duct Sealer, Hardcast "Iron-Grip 601", Childers CP-146, Foster 32-18 or Polymer Adhesive Sealant Systems, Inc. "Air Seal No. 11" duct sealer installed in the joints after closure. All sealants shall be U.L. rated for the application. Seal all external transverse joints,

longitudinal seams, and all fitting connections externally to include sealing all duct work accessories, connections to accessories and duct and accessory penetrations (tubes, rods, wires, etc.). Do not seal control rods for actuated dampers and fasteners. Each system shall meet a seal class of "A".

5. Low Pressure Duct Supports:

   a. All horizontal ducts up to and including 40 inches in their greater dimension shall be supported by means of No. 18 U.S. gauge band iron hangers attached to the ducts by means of screws, rivets or clamps, and fastened above to inserts, toggle bolts, beam clamps or other approved means. Duct shall have at least one pair of supports 8'-0" on centers. Clamps shall be used to fasten hangers to reinforcing on sealed ducts.

   b. Horizontal ducts larger than 40 inches in their greatest dimension shall be supported by means of hanger rods bolted to angle iron trapeze hangers. Duct shall have at least one pair of supports 8'-0" on centers according to the following:

Angle Length	Angle	Rod Diameter
4'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
8'-0"	2" x 2" x 1/8"	5/16"
10'-0"	3" x 3" x 1/8"	3/8"

   c. Vertical ducts shall be supported where they pass through the floor line with 1-1/2" X 1-1/2" X 1/4" angles for ducts up to 60". Above 60" the angles must be increased in strength and sized on an individual basis considering space requirements.

6. All low pressure ductwork shall be reinforced to maintain a maximum reinforcement spacing as scheduled with the rigidity classification as needed to meet the specification construction standard. Reinforcement spacing shall be reduced as required to meet the construction standard specified using the gauge thickness scheduled.

C. Non-Metal Fabric Duct:

1. Fabric Tensioning System, equal to Skelecore FTS: Air diffusers shall be constructed with internal tensioning frame.
2. System shall cylindrically tension textile along the entire length of textile duct, including all fittings(crosses, elbows, reducers and tees).
3. Tensioning system shall include full 360 degree tensioning and intermediate rings with quick connection spacer tubes concealed inside the fabric system.
4. Interior structure to include multiple mechanically adjustable tension devices. To provide proper textile tensioning, structural and textile system shall be configured in segments of no more than 45 feet.
5. Textile components supported solely by metal cylindrical rings.
6. Each cylindrical ring shall require a vertical metal to metal cable safety attachment.
   a. Vertical supports are Galvanized steel with available lengths of 5' (standard), 10', 15', & 30'.
7. Available for diameters from 8" – 84".
8. Not available for natatorium applications.
9. Textile Type: Verona
   a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.
   b. Air Permeability: 2 (+2/-1) CFM/ft^2 per ASTM D737, Frazier
   c. Weight: 6.8 oz. /yd^2 per ASTM D3776
   d. Warranty: 15 years with standard inlet velocity.
10. Textile Color
   a. Royal Blue, Confirm with Architect

11. Textile System Fabrication Requirements:
    a. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps, and mid-sections) and top access zippers for vertical cable safety attachment.
    b. Integrated air dispersion shall be specified and approved by manufacturer:
        1) Linear Vents
            a) Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting at 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
            b) Size of vent openings and location of linear vents to be specified and approved by manufacturer.
    c. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.
    d. Inlet connection includes zipper for easy removal / maintenance.
    e. Lengths to include required intermediate zippers as specified by manufacturer.
    f. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
    g. End cap includes zipper for easy maintenance.
    h. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

12. Design Parameters:
    a. Textile air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard.
    b. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
    c. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.

13. Installation, Cleaning and Protection of Fabric Duct System:
    a. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.
    b. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
    c. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
    d. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

14. Acceptable Fabric Duct Manufacturers:
    a. DuctSox Corporation.
    b. FabricAir.

D. Round Flexible Insulated Ductwork:

1. All round flexible insulated ducts, low and high pressure type, shall be factory fabricated and insulated as manufactured by Thermaflex or Flexmaster USA, Inc. Flexible ducts shall be equal to Thermaflex factory insulated type "M-KC" or Flexmaster “Type 3M”.
2. Flexible duct thermal conductance shall be based on a 75 Deg. F. mean temperature and an aged condition (not out of the box value). Flexible duct insulation shall be a minimum nominal two inches (2.0") in thickness with a minimum 0.75 lb. density. The completed duct assembly shall have a minimum R-value of 6.0. To verify compliance with the Energy Conservation Code in effect, the minimum R-value of 6.0 will need to be documented on the outside of the jacket to allow field verification of compliance with this requirement.
3. The core liner of the flexible duct system shall be a tri-laminate aluminum foil, made with fiberglass and aluminized polyester, or a PVC coated fiberglass cloth. The outer liner shall be a polyester reinforced aluminized foil jacket.
4. Flexible ducts shall be U.L. Listed in accordance with U.L. 181 as a Class I insulated air duct, and shall comply with NFPA Standard 90A and 90B. Flexible ducts shall have a maximum flame spread of 25 and maximum smoke developed rating of 50.
5. Flexible ducts shall be suitable for operating temperatures of -20 up to 250 Deg. F.
6. Flexible ducts shall be suitable for negative pressures of minus one inch W.G. in sizes up to 16" in diameter; and positive pressures up to 10 inches W.G. for sizes up to 16" in diameter. Maximum operating duct velocity rating shall be a minimum of 4,500-5,500 feet per minute.
7. Maximum vapor transmission rating shall be 0.05 Perms as rated in accordance with ASTM-E-96.
8. Unless otherwise noted, the maximum length of flexible duct shall be limited to five feet (5').
9. Securement of flexible ducts to air devices shall consist of sliding the duct onto the air device collar or connector and securing it with plenum rated nylon or teflon panduit band on the inner liner which shall be U.L rated for the application. Fold insulated outer vapor barrier jacket liner over the first band and secure with a second plenum rated panduit band. Make connection vapor tight with a vapor barrier seal using polyester reinforced aluminized duct tape that is two inches (2") wide, wrapped 2 times around the duct, or by the use of a fiberglass mesh wrapped in a similar fashion and coated with a vapor barrier coating, Foster’s Vapor Safe 95-90 or 95-96 mastic or Childers CP-38. Coating must adhere to MIL-PRF-19565C with a permeance rating of less than 0.02 perms per ASTM-E-96, procedure B. No cloth backed duct tape is allowed. All fasteners, adhesives, and duct tape used shall be U.L. rated for the application. All duct tapes used shall be acrylic based.

2.2 FIRE, SMOKE, AND COMBINATION SMOKE-FIRE DAMPERS

A. Contractor shall furnish and install fire, smoke, and combination smoke-fire dampers in air passages, openings, and ductwork wherever shown on the Drawings, and as required by the local authorities having jurisdiction. Installations shall be in accordance with all applicable NFPA standards and the SMACNA Duct Manual. All dampers shall carry the U.L. Label and shall be installed such as to conform to conditions under which the U.L. Label was granted. All dampers shall be constructed and tested in accordance with the latest edition of U.L. Safety Standards 555 or 555S, as applicable. Provide sleeves, typically 12" in length minimum, for all dampers as required for the installation conditions encountered.

B. Fire dampers shall be constructed in accordance with the recommendations of the NFPA and shall be of metal gauges required by the class of separation in each case.

1. Interlocking curtain blade type fire dampers carrying the Underwriters' Label will be acceptable, except at locations where an operating type damper is required to meet local requirements, to meet sequence of operations indicated in Temperature Control Specifications, Section 23 0900, or to meet the limited spaces available.
2. Use Style "B" rectangular and style "CR" for round dampers such that blades are out of the air stream.
3. For grille installations at fire rated partitions, use Style "B" thin line fire dampers or Style "G" integral sleeve type for grilles.

C. Smoke dampers shall be designed for vertical or horizontal applications as encountered in accordance with NFPA 90A and meet the latest requirements of UL 555 S. Smoke dampers shall be installed in, or adjacent to, the smoke barrier; but in no case, more than 24 inches from the smoke barrier. Smoke

dampers shall be a Ruskin Model SD35, 36, 37, or SDRS25 as applicable for the application. Frames shall be made of 16 gauge single piece galvanized steel hat shaped channel frames. Blades shall be 6" wide galvanized steel and be the triple V-groove or air foil type. Provide stainless steel jamb seals, silicone edge type blade seals where required for the classification, stainless steel sleeve bearings and linkages concealed in the frame. Leakage Class shall be Class 1, 2, or 3, as required, to meet the requirements specified elsewhere herein. Provide compatible electric actuator on all dampers, factory installed.

D. Combination fire-smoke dampers shall be Leakage Class 1 dampers with electric, manually resettable, fuse link operated by 120 volt electric actuator furnished with the damper. Fire-smoke dampers shall be Ruskin FSD-60, or equal, with minimum 16 gauge galvanized steel hat channel shaped frames. Fire-smoke dampers shall be increased in size to maintain a minimum of 90 percent free area of the ductwork size indicated on the Drawings thru each fire-smoke damper. Leakage shall be Class 1, 2, or 3, as required, to meet the requirements specified elsewhere herein. Provide compatible electric actuator on all dampers, factory installed.

E. Insulated all metal access panels, secured with sash locks, and shall be installed to service all fire, smoke, and combination smoke-fire dampers. Access panels shall be identified with "FIRE DAMPER", “SMOKE DAMPER”, or "SMOKE-FIRE DAMPER" stenciled thereon in a visible or conspicuous location. Removable flexible duct shall not be permitted as a means of damper access. Access shall be direct and shall not be obstructed by turning vanes or other duct accessories.

F. General Requirements:

1. For “Ductmate” connections at fire, smoke, or combination smoke-fire dampers, do not use screw fasteners.
2. Use four inch (4") draw band connections at round duct fire damper connections.
3. Use blade dampers when the blade width exceeds 12 inches.
4. Install vertical or horizontal mount dampers suitable for the application.
5. Dampers shall be suitable for the maximum air system operating pressures expected to be encountered. Medium pressure ductwork is expected to operate at up to six inches (6") W.G.
6. Use multi-section dampers where damper size openings are larger than single section maximum sizes.
7. Fire, smoke and combination smoke-fire dampers shall be sized to provide for 100 percent of the ductwork size (minimum 95% free area) indicated on the Drawings through each damper.
8. Provide 165 Deg. F. rated fusible links for fire dampers.

G. Acceptable Manufacturers:

1. Ruskin, or approved equals by:
2. Greenheck, or
3. Nailor, or
4. Prefco, or
5. National Controlled Air (N.C.A.), or
6. Air Balance, or
7. Pottoroff.

2.3 FLEXIBLE CONNECTIONS

A. Where ducts connect to fans, including roof exhausters, flexible connectors shall be made that are fire-resistant, (up to 200 Deg. F.), waterproof, mildew-resistant and essentially airtight, and shall weigh approximately thirty ounces (30 oz.) per square yard.

B. There shall be a minimum of one-half inch (1/2") slack in these connections, and a minimum of two and one-half inches (2-1/2") distance between the edges of the ducts for a total of three inches (3"). There shall also be a minimum of one inch (1") of slack for each inch of external static pressure on the fan system for medium pressure systems.

C. Acceptable Manufacturers:

1. Vent Fabrics "Ventglas", or approved equals by:
2. Duro-Dyne.

2.4 ACCESS DOORS

A. Furnish and install hinged, low leakage access doors in ductwork or plenums to provide access to all fire, smoke and combination fire - smoke dampers, mixed air plenums, automatic dampers, coils, filters, and elsewhere as detailed on the Drawings.

B. Where the ducts are insulated, the access doors shall be double skin doors with a minimum one inch (1") of insulation in the door. The insulation shall have a minimum R-value of 5.0. Increase the thickness of the insulation as needed to comply. Where the access door is installed in non-insulated ductwork the access door shall be unlined sheet metal of the same gauge thickness as the duct.

C. In no case shall access doors be smaller than eight (8") by eight inches (8"). Access doors shall be sized to permit testing or servicing of duct mounted components, such as, for coil cleaning, installation of control devices, resetting of fusible links, filter replacement, etc., as applicable and suitable for the application.

D. Where duct access doors are above a suspended, normally non-readily accessible ceiling, such as plaster, gypsum board or spline type ceilings, Contractor, under this Section of Specifications, shall be responsible for the proper location, and furnishing of, ceiling access doors, or panels, to make duct access doors easily accessed through the ceiling system. Ceiling access doors, or panels, shall be rated, where applicable, to match the fire rating of the ceiling system penetrated. Ceiling access doors, or panels, shall be installed under other Sections of these Specifications. Ceiling access doors, or panels, shall be centered directly beneath duct access doors or immediately adjacent thereto when duct access is through the side of the duct.

E. All access doors shall be fully double gasketed, door to frame and frame to duct, and include a sash type or compression latches for sizes under eighteen inches (18") by eighteen inches (18"). Use one (1) sash type latch per twelve inches (12") of height or width. Access doors 18" x 18" and larger shall have quarter turn handle latches. Provide one handle per 24" section, height or width, of door. As an example, provide two (2) handle type latches for a 48" tall access door.

F. Provide a minimum of two (2) heavy loose pin hinges for each access door unless indicated otherwise herein. Piano style hinges will be an allowed substitute.

G. Where the installation conditions prohibit suitable access with hinged access doors, then non-hinged access doors may be used in conjunction with a corrosion resistant cable or chain, of suitable length, attached to the access door and duct.

H. For duct systems constructed to 2 inches W.G standards, or less, provide standard access doors meeting all requirements specified herein, which have a tested air leakage rating of less than 4.0 CFM at a test pressure of 2 inches W.G., and as manufactured by:

1. Ventlok with hinges and No. 90 or No. 99 latches (less than 18" x 18"), or No. 100 or No. 140 latches (18" x 18" and larger), as applicable, or approved equals by:
2. Ductmate, or
3. Duro Dyne DDIAD-0806, or
4. NCA Manufacturing ADH-T-1, or
5. Pottorff HAD or CAD, or
6. Nailor 08SH with HP Seal, or 0890, or
7. Cesco Products HDG, or
8. Ward Sandwich Style Access Doors, DSA or DDA, for round ductwork.

I. For duct systems constructed over 2 inches W.G., up to 6 inches W.G. standards, provide high pressure low leakage access doors meeting all requirements specified herein, which have a tested air leakage rating of less than 1.0 CFM at a test pressure of 6.0 Inches W.G. and as manufactured by:

1. Ventlok similar to that noted above, or their Twist-In Door (insulated), or approved equals by:
2. Ductmate “Sandwich” (Rectangular ducts), or Ductmate “Metu” (Round ducts), or
3. Ward Duct Connector Industries Type ‘F’ (Rectangular ducts) or Type ‘R’ (Round Ducts), or
4. Nailor 0820-1 or 0895, or
5. Pottoroff OAD.

2.5 TURNING VANES

A. Turning vanes shall be Harper double wall turning vanes fabricated from the same material as the duct.

B. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vanes shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer’s instructions.

C. Rails for mounting vanes shall have self-locking, friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in Figure 4-3 of the 2005 SMACNA Manual, “HVAC Duct Construction Standards, Metal & Flexible”, Third Edition standard. Rail systems with non-compliant tab spacing shall not be accepted.

D. Acoustical Turning Vanes shall be used in applications that require quiet operating systems. Mounting rails shall have friction insert tabs that align the vanes automatically. These shall only be required where designated on the Drawings.

E. Approved Manufacturers:

1. Ductmate Industries PRO-Rail Turning Vane or approved equals.

2.6 DUCT LINER

A. Where indicated on the Drawings or specified herein, all rectangular ducts; except kitchen grease hood and fume hood exhaust ducts; shall be lined with Fiberglass mat faced duct liner in the thicknesses, type, and locations as indicated elsewhere herein for the first 10’-0” from the unit, unless installed in an exposed ceiling space in which case they shall be internally lined throughout.

B. Kitchen grease hood exhaust, kitchen hood make-up air, and fume hood make-up air and other industrial type exhaust air ducts shall not be lined. Line all other general building exhaust air ducts within 10'-0" on each side of each in-line exhaust fan with one inch (1") thick liner. Roof mounted exhaust fan ductwork shall also be lined, one inch (1") thickness, but only for the first 10'-0" of ductwork from the roof curb toward the occupied space.

C. All return, transfer, and relief air ducts shall be lined with one inch (1") thick duct liner for the first 10’-0” from the unit.

D. The liner insulation system shall be one and one-half inches (1.5") in thickness on all conditioned air, heated or cooled, as well as outside air intake ducts, and mixed air plenums to obtain a minimum R-value of 6.0 thereon for the first 10’-0” from the unit.

E. All ductwork in sound sensitive areas shall be internally lined full length of ductwork from unit to duct run-out. Provide 2” think internal liner in all sound sensitive areas.

F. All ductwork systems are required to meet the most recent version of the International Energy Conservation Code.

G. All duct liners shall comply with NFPA 90A and 90B and ASTM C 1071, Type I, for ducts and Type II for plenums (rigid liner). Liner shall consist of flexible, matt faced insulation made of inorganic glass fibers

bonded by a thermosetting resin with an encapsulant edge coating, and shall be a rotary style duct liner product with a water repellant ingredient on the mat face to help keep moisture from penetrating the air stream surface. Other technical requirements shall include:

1. Be suitable for temperatures up to 250 Deg. F. per ASTM C 411.
2. Be suitable for air velocities up to 6,000 FPM per ASTM C 1071 for Type I products and 5000 FPM for Type II products.
3. Water vapor sorption shall be less than 3% by weight per ASTM C 1104.
4. Air stream surface mat facing shall be tested with an EPA registered anti-microbial agent to aid in the prevention of fungal and bacterial growth. Mat face, as treated, shall not support the growth of mold, fungi, or bacteria per ASTM C 1338, ASTM G 21 and ASTM G 22.
5. Does not exceed a Flame Spread of 25 and Smoke Developed and Fuel Contributed of 50 per ASTM E 84, NFPA 225, and UL 723.
6. Conductance of 0.24 (R-value of 4.2) for a 1.5 PCF or 2.0 PCF duct liner at a 75 Deg. F. mean temperature per ASTM C177 for a one inch (1") thick product.
7. Greenguard Compliant (Greenguard Environmental Institute).
8. Noise Reduction Coefficient (NRC) of 0.70 or higher for a one inch (1") thick product and 0.80 for a two inch (2") thick product per ASTM C 423, type A mounting.

H. All duct liners shall be able to be cleaned in accordance with the North American Insulation Manufacturers Association (NAIMA) “Cleaning Fibrous Glass Insulated Air Duct Systems Recommended Practices”.

I. Liner shall be applied to the inside of rectangular ducts and plenums with fire-resistant adhesive, Fosters 85-60, 85-65, or Childers CP-127, Hardcast “Seal-Tack” or Ward “Premium Duct Liner Adhesive”, or approved equals only, complying with ASTM C 916, completely coating the clean sheet metal. All uncut joints in the insulation shall be “buttered” and firmly butted tightly to the adjoining uncut liner using the same fire resistant adhesive.

J. Where a cut is made in the insulation for duct taps, etc., the “raw” edge shall be accurately and evenly cut and shall be thoroughly coated with a water based fire resistant adhesive. Where tears in the insulation occur coat such with the same adhesive (duct liner protective coating). Adhesives shall be Design Polymerics Duct liner Protective Coating (2510/2515/2540/2545), Ductmate Super Liner Seal (SLS), or approved equals only.

K. On ducts over twenty-four inches (24") in width or depth, the liner shall further be secured with mechanical fasteners. Fasteners shall be Graham or Gemco weld pins. "Stick Clips", "Sheet Metal Clips", or other fasteners secured to the ducts by adhesive are not allowed. Fasteners shall be placed on a maximum spacing of eighteen inches (18") and shall be pointed up with fire-resistant adhesive. Fasteners shall not compress the insulation more than 1/8".

L. Liner shall be accurately cut with all cut ends thoroughly coated with an approved liner edge coating adhesive so that when the duct section is installed, the liner shall make a firmly butted and tightly sealed joint. Provide metal nosings securely installed over transversely oriented liner edges facing the air stream at all fan discharges, at access doors, and at any interval of lined duct preceded by unlined duct. This adhesive type shall be Duro Dyne “Dyn-O-Coat”, or equal. This shall be an aerosol which is quick drying, flexible and tack free. Treat all exposed edges, butt seams, and inadvertent tears.

M. Where rectangular ducts are lined and adjoins externally insulated rectangular ducts, the two insulations shall be overlapped not less than twenty-four inches (24").

N. Dimensions given on the Drawings are inside air stream, free area, dimensions only and sheet metal sizes shall be increased in size to maintain these free area dimensions when liner is installed.

O. All exposed ductwork shall be internally lined unless specifically indicated otherwise.

P. Refer to Section 23 07 00, Insulation, for further related requirements.

Q. Acceptable liner manufacturer shall be:

1. Certainteed, Tough Gard R with enhanced surface.
2. Knauf, Rotary Duct Liner E-M with Hydroshield.
3. Owens Corning, Quiet R Acoustic Duct Liner, Type 150 or equivalent Duct Liner Board.
4. Johns Manville, Linacoustic RC or R-300.

2.7 GRILLES, REGISTERS, AND DIFFUSERS

A. Grilles, registers, ceiling outlets, diffusers and other air devices shall be as scheduled on the Drawings and shall be suitable for the intended use.

B. Provide air devices with sponge rubber or soft felt gaskets at flanges where the devices mate up to a ceiling or wall surface.

C. If a manufacturer other than the one scheduled is used, the sizes shown on the Drawings shall be checked for performance, noise level or criteria, face velocity, throw, drop, pressure drop, air diffusion, etc., before the submittal is made. Selections shall meet the manufacturers' own published data for the above performance criteria. The throw shall be such that the terminal velocity will be not more than 50 FPM or less than 25 FPM at the point of penetrating the occupancy zone. The occupancy zone is defined as six feet (6') above the finished floor and six inches (6"), or farther, from the walls.

D. Noise levels shall not exceed those published in current ASHRAE Standards and Guidelines for the type of space being served (N.C. level) or that scheduled.

E. Locations of outlets on Drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be governed by the established pattern of the lighting fixtures, structure and Architectural Reflected Ceiling Plan (RCP). Air devices shall have margins, frames, and sizes to be compatible with the ceiling and wall systems installed. All color and finishes are subject to final approval by the Architect.

F. Where called for on the schedule, grilles, registers, ceiling outlets, diffusers and other air devices shall be provided with deflecting devices and manual dampers.

G. Where indicated on the Drawings, provide a fire rated blanket on the back side of steel ceiling mounted air devices (supply, return, exhaust, etc.).

H. Where indicated on the Drawings, provide an insulation blanket on the back side (all surface area) of ceiling mounted supply air devices to prevent condensation.

I. All air devices shall be the standard product of the manufacturer, subject to review by the Architect. Acceptable manufacturers are:

1. Titus, or approved equals only by:
2. Krueger.
3. Nailor.
4. Metal-Aire.
5. Carnes.
   Price Industries.

2.8 DRYER VENT EXHAUST DUCT SYSTEM

A. Dryer vent exhaust duct work shall be constructed of minimum 26 gauge galvanized steel or aluminum sheet metal. Sheet metal gauge shall be increased in size to correspond to table in Paragraph 2.1C.3 for low pressure round ductwork.

B. All duct work shall have a smooth interior finish and have interlocking fittings so that they do not require screw fasteners. No screw fasteners shall be used that puncture duct work. Support duct work at

minimum four foot (4') intervals. All transitions shall be made outside of the duct wall. Refer to Section 504 of the 2009 International Mechanical Code (IMC) for additional requirements.

C. For all dryer vent exhaust ducts concealed in building construction (i.e., in walls or above inaccessible ceilings), provide a permanent identification label or tag located within six feet (6') of the dryer connection, that lists the total equivalent length of the exhaust duct as defined by the IMC or the Manufacturer (Where longer than 35 equivalent feet note the allowed length of the dryer manufacturer). Label to be mounted to wall near exhaust duct and comply with equipment tag label requirements in Section 23 05 53.

D. Provide termination caps or hoods with a backdraft damper but without screens. Refer to Drawings for details of terminations.

2.9 OUTSIDE AIR INTAKE

A. Furnish and install outside air intakes and relief air outlets of sizes as scheduled or shown on the plans. Face velocities shall generally not exceed 1000 FPM for outlets and 500 FPM for intakes. Air pressure drop shall not exceed 0.10 In. W.G. in all cases.

B. Hoods shall be of all welded and lock formed galvanized steel or all aluminum construction. Furnish with aluminum bird screen and a removable sloping top insulated on the bottom with mastic insulation and coated with an anti-condensate coating. Hoods shall be hinged for access to ductwork and shall be fastened closed.

C. Furnish minimum 18 inch high curbs for intakes made of 16 gauge spot welded galvanized steel and insulated on the inside of the curb with 2" thick fiberglass board for thermal insulation and to prevent condensation. Provide wood nailer for fastening.

D. Provide a 2" wide neoprene rubber pad continuous around the curb for mounting of intake to provide a weather seal and to damper wind born vibration. Secure hoods with stainless steel screws 8" on centers.

E. Acceptable hood manufacturers:

1. Penn "Airette", or approved equals by:
2. Greenheck.
3. Loren Cook.
4. Acme.

2.10 AIR FILTERS

A. Provide appropriately sized and number of air filters for each piece of individual air handling equipment to include, but not be limited to, the following:

1. Packaged Rooftop A/C Units.
2. Ductless Split DX AC Units.
3. Elsewhere as required to protect air type heat exchangers, such as warm air furnaces, or coil surfaces, such as duct mounted direct expansion coils.

B. Medium efficiency air filters shall generally be two inches (2") thick, unless indicated otherwise and shall be the pleated media, disposable type, listed by Underwriters Laboratories as Class 2, with the following features:

1. Air filters shall be rated in accordance with the most recent version of ASHRAE Standards 52.1 and 52.2, test methods as indicated herein, and shall conform to Section 7.4 of ARI Standard 850.
2. Filter media enclosing frame shall be constructed of rigid, heavy duty, high wet-strength resistant, “beverage” board with diagonal support members on the air entering and air exiting sides. Expanded diamond grid media support, integral with frame, shall be chemically bonded to filter media at each pleat, to insure pleat spacing and stability. Pleated media shall be bonded to the inside of the frame to eliminate air bypass.

3. Filter media shall be high performance, non-woven, reinforced cotton-poly, synthetic blend fabric formed in a V-shape.
4. Filters shall have the following performance data:

THICKNESS	SQUARE FEET MEDIA AREA TO ONE SQUARE FOOT FACE AREA	MINIMUM PLEATS PER LINEAL FOOT	INITIAL AIR RESISTANCE (INCHES W.G.)	RESISTANCE BASED ON AIR FLOW OF
One Inch (1")	2.4	16	0.25 (350 FPM)	1400 CFM
Two Inch (2")	4.3	15	0.28 (500 FPM)	1500 CFM
Four Inch (4")	6.9	11	0.27 (500 FPM)	1500 CFM

5. Filters shall be suitable for operation with varying velocities of up to 500 feet per minute (FPM) for 2" and 4" filters and 350 FPM for 1" filters.
6. Filters shall have a minimum efficiency of 30% with an average arrestance of 90 to 92% minimum dust holding capacity which shall be no less than 170 grams as tested in accordance with ASHRAE Standard 52.1. Filters shall also have a MERV rating of 8 as tested in accordance with ASHRAE Standard 52.2-2007.
7. Acceptable Manufacturers:
   a. Camfil Farr, Inc., Model Aeropleat IV, or approved equals by:
   b. Environmental Filter Corporation.
   c. Eco-Air.

C. All filters shall be standard sizes that are readily and locally available, in stock, through multiple over the counter sources without requiring special order. Standard acceptable sizes shall be 16" x 20" and 16" x 25".

2.11 ADHESIVES AND SEALANTS

A. All adhesives and sealants used on this project must have a Volatile Organic Compound (VOC) content less than that listed in the current South Coast Air Quality Management District (SCAQMD) Rule 1168, and all sealants and fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

B. All adhesives and sealants shall meet the most current Leadership in Energy and Environmental Design (LEED™) requirements.

2.12 FIBERGLASS DUCTBOARD

A. Fiberglass duct board of any type is not allowed on this project without exception.

2.13 ELECTRONIC BALANCING DAMPERS

A. Where balance dampers are to be located above a hard ceiling, or in any inaccessible location, the contractor shall use electronic balancing dampers controlled with an Electronic Balancing Damper Positioner (EBDP) which opens and closes the damper and provides a visual indication of the damper position with a LCD meter.

B. Each Remote Damper Assembly shall consist of a commercial quality damper actuated by a 12V DC motor with position feedback, a plenum rated cable with RJ-25 connectors on each end, termination options to control the damper from either a plenum, wall or ceiling location, and a hand held damper positioner that provides DC voltage to open and close the damper while displaying the damper position with the LCD position indicator meter.

C. Each damper shall be either a round, rectangular, or High Efficiency Takeoff type damper, as applicable to the installation. Round dampers shall consist of a 20 gauge galvanized steel shell and blade with ½" plated steel damper shafts, and 12V DC Motor with position feedback. Rectangular dampers shall consist of a 20 gauge aluminum frame and blade, stainless steel slide, 18 gauge galvanized steel mounting plate for slip in installation, and 12V DC motor with position feedback. High efficiency takeoff dampers shall consist of a galvanized steel takeoff with 20 gauge blade and ½" steel shafts, and 12V DC motor with position feedback. Dampers shall include oil impregnated bronze bushings. Damper actuators shall use less than 0.5 watts of power (20 mA), have a torque capability of 16 inch-pounds (maximum), and rotate the damper from 0 - 90 degrees in 12 seconds of less. Feedback shall occur via a proportional voltage signal. Provide low leakage damper blade seals.

D. Electric Cables shall be plenum rated cable, have modular connectors and be available in lengths up to 1,000 feet. Length of individual cables shall be field verified to insure no field splicing of cables is required. One modular connector shall be attached to each motor and the other end shall include a RJ-25 modular connector that would be installed inside a plenum or at a wall or ceiling receptacle, to be coordinated with the architectural drawings (acceptable locations). Ceiling connections shall be the concealed type similar to Young Regulator Company (YRC) TP -301. Wall connections shall be the suitable for 1- 6 ports and be similar to YRC TP-Wall.

E. The Positioner (EBDP) shall be used to control all remote electronic balance dampers installed on site by use of ceiling or wall mounted receptacles, a plenum connection or a combination of these options. The Positioner shall be self-contained and be a hand held device. Each positioner shall be provided with a high capacity long life lithium battery which shall be easily replaced in the field. Provide one (1) Positioner for each site or building to include one (1) spare battery for each positioner furnished. Positioner shall use a modular RJ-25 connector that plugs into the modular connector served by the 12V DC motor. The positioner battery shall drive the damper motor open and closed. The positioner shall also house the LCD display that provides precise damper position indication throughout the range of movement via a proportional voltage feedback signal from the motor.

F. Acceptable Manufacturers:

1. Young Regulator.
2. Greenheck.
3. Metropolitan Air Technology (MAT).
4. Or other approved equals.

2.14 EXTRUDED ALUMINUM FEMA 361 (ICC STANDARD 500-2014) GRILLE (LOUVER/BAFFLE)

A. Furnish and install heavy duty fabricated aluminum grilles, louvers, or baffles, at all penetrations made through walls or roof of the International Code Council (ICC) Standard 500-2014, Standard for the Design and Construction of Storm Shelters in the sizes, locations and configurations as shown on the Drawings.

B. Aluminum Grilles, louvers or baffles shall be made of heavy duty welded aluminum blades having a chevron shape, or inverted “V” shaped blades, to prevent direct flying debris from directly entering the storm shelter penetrations or openings. All grilles shall be rated to comply with the requirements of Federal Emergency Management Agency (FEMA) 320 or 361 testing requirements (for protection from high wind loads and air borne debris or projectiles).

C. Aluminum grilles may be installed in the wall or roof on the outside portion of any penetration as a stand-alone device, in front of standard wall louvers or in front of an internal shutter or door of standard construction to close off the opening when not in use for the transfer of air (forced air circulation) or for natural ventilation air purposes. The grilles shall be rated for a minimum wind load of 248 Pounds per Square Foot (PSF), 250 Miles Per Hour (MPH), and be able to withstand a 15 pound wooden 2” by 4” traveling at a minimum of 100 MPH.

D. Grilles shall provide for a high free area and very low air pressure drop or airflow resistance.

E. Provide the minimum free area, in square feet, for each size grille, as designated on the drawings. Submit individual data for each grille to include individual sizes, air flow rates, air pressure drops (to include accounting for interior debris screens), frame types, color and finish selection options, cut sheet data of dimensions and weights for each size to be used, installation instructions and any other data as requested by the structural engineer as needed to verify acceptable performance and suitability for actual mounting conditions encountered.

F. All grilles shall be Underwriters Laboratories (UL) listed as a wind storm rated assembly.

G. Provide mounting frames for all grilles of a flush in wall, recessed in opening, with an eight inch (8") deep frame made of ¼" thick aluminum with framed flanges on two opposite ends. The inverted "V" blades shall also be made of minimum 3" by 3" by ¼" thick aluminum which shall be fully welded, and then welded into the frame. Cantilever style frames not allowed unless specifically detailed not to be flush in the wall or roof penetration.

H. Provide a stainless steel ½" by ½" size mesh, using 18 Gauge wire, debris screen to be mounted on the inside shelter side of the grille. Alternately a flattened aluminum bird screen is acceptable.

I. Provide a flush, recessed mount grille frame (flush with the outside finished wall surface). Additionally provide an eight inch (8") extended wall sleeve if an additional louver is detailed to be installed behind the storm rated grille.

J. All grilles shall be made from aluminum unless otherwise noted. Where steel components may be allowed, only where designated, these shall be powder coat painted in an Owner/Architect selected color from a manufacturer furnished color palette, minimum 20 unique colors to be available for selection. Factory finishes shall be warranted for a minimum of one (1) year from the date the grilles are placed into beneficial use of the Owner, generally coinciding with Substantial Completion. Aluminum grilles shall have an aluminum mill finish.

K. Provide removable aluminum or steel (only where designated) lifting lugs which shall be removed at the completion of installation. Touch up any paint finishes should such be marred during installation, as applicable.

L. All grilles shall be installed in accordance with the grille manufacturers recommended installation instructions. Perimeter of grilles to be sealed with a non-hardening flexible outdoor rated sealant. Use stainless steel rods or bolts with anchors and epoxy (rods) or plate washers or tap and nut (metal structures) in the sizes, penetration depth and spacing as per the pertinent FEMA rating of the grille.

M. Refer to Structural Engineering and Architectural Drawings for all mounting conditions and details to include identification of the structural wall or roof material being penetrated.

N. Storm rated grilles shall be as manufactured by:

1. Ruskin, Model XP500.
2. Greenheck, Model AFL-501.
3. Pottorff, Model XAV-545.

2.15 ROUND LOW PRESSURE DUCT TAPS

A. Provide round low pressure, systems operating at a maximum of two inches (2" inches) water gauge (W.G.) static pressure, duct taps to serve air devices where shown on the drawings and in accordance with details for these taps

B. Duct taps shall consist of spin-in, or spin on, collar type manufactured fittings specifically made for commercial ductwork systems. Spin-in fittings shall be either the straight or conical type as shown and detailed on the drawings to include integral manual balance damper with locking device. Fittings shall be fabricated using continuous weld longitudinal seams. No riveted construction allowed.

C. All spin-in fittings shall be made with hot dipped, G-60 or G-90, galvanized steel (per ASTM A 653) and be a minimum of 26 gauge in thickness for all sizes from 4” to 12” round. All sizes 14” to 20” round shall be a minimum of 24 gauge in thickness. Thicker gauges shall be provided on larger fittings as required per SMACNA and the Mechanical Code, where required.

D. Provide plain or beaded ends for connection of duct work as required for the application. Crimped ends are not allowed.

E. All ductwork systems are called out elsewhere in these specifications to be externally sealed to limit air leakage. These fittings may either be factory sealed (all seams sealed) or be sealed by the contractor in the field.

F. All spin-in fittings shall also include integral manual balance dampers unless indicated otherwise. Damper options shall be as follows:

1. All manual volume dampers shall be the butterfly type, using a single round damper blade and positive locking regulator damper hardware.
2. Sizes 4”-12” round shall have a reinforced damper axis (not a continuous damper shaft) with ¼” regulator and spring loaded, retractable bearings.
3. Sizes 14” through 20” round shall have a minimum 3/8” continuous damper rod axis with nylon grommets installed at damper sleeve penetrations.
4. Provide dampers, which shall include an extended threaded shaft that aligns with a sheet metal stand-off bracket (spot welded to the fitting) with the stand-off distance to be 2” to clear the thickness of any external duct wrap insulation. Coordinate stand-off dimensions with specified duct insulation thickness (only when thicker than 2”). Damper handle and wing nut to be fastened at the outside of the stand-off bracket.
5. Provide premium optional balance dampers to include a 2” stand-off bracket, spot welded to the fitting, to include a 3/8” square shaft extended to the stand-off bracket, with U-bolt, nylon bushings, locking quadrant and handle.

G. Acceptable Manufacturers:

1. Flexmaster or equals by,
2. Crown Company Products,
3. Ductmate,
4. Hercules Industries.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all ductwork and equipment as indicated on the Drawings in full accordance with these specifications including foundations, hangers, supports, etc.

B. Seal all ductwork as specified, pressure test and repair leaks.

C. Install all air intake, relief and exhaust air hoods on continuous neoprene strips set level on top of wood nailers of the specified roof curbs. Hoods shall be secured at 8" O.C. to the curbs with corrosion resistant screws if not secured by other fasteners as specified. Flash and counterflash to prevent water leakage through the overall roofing system.

D. Install all duct mounted components such as heating coils, electric or water type, sound attenuators, air terminals, etc. in accordance with the manufacturer’s recommendations.

E. Should defects or installation deficiencies become apparent, or are observed, after the systems have been in operation, the deficient components shall be removed and replaced or reinforced as directed by the Owner's Representative.

3.2 CLEANING OF DUCT SYSTEMS

A. Before the grilles or diffusers are installed, all fans and air conditioning units shall be operated and all debris and foreign matter shall be removed from the ducts.

B. The air conditioning units shall be thoroughly cleaned, and the drain pans shall be thoroughly cleaned and flushed out with a hose; the filters shall be thoroughly cleaned and the grilles shall then be installed.

C. Insure all duct openings are capped and sealed during construction when additions are not being made.

3.3 AUTOMATIC CONTROL DAMPERS

A. Refer to Section 23 09 00, Controls and Instrumentation.

B. Install all temperature control modulating dampers under this section of the specifications, furnished in Section 23 09 00.

3.4 FILTERS

A. No air moving equipment may be operated at any time without filters being fully installed in equipment.

B. Provide a minimum of three (3) spare sets of two inch (2") thick, medium efficiency, pleated media filters for all air handling and fan coil units, as well as for filter return air grilles where scheduled, in addition to manufacturer furnished filters specified elsewhere herein. Where other sections of these specifications require one inch (1") or four inch (4") thick filters, or other types of filters, provide spare sets of matching thickness and type.

C. Additionally replace filters during construction as directed by the Owner's Representative.

D. Install one (1) new complete set of filters, as directed by the Test and Balance (TAB) Firm, just prior to performance of TAB work.

E. Install one (1) new set of filters at "Substantial Completion" of the project.

F. Where the minimum number of filter sets are not used for the aforementioned purposes, provide the left over filters to the Owner for maintenance stock.

G. Document, in writing, when each filter change-out occurs.

END OF SECTION

SECTION 23 34 00

EXHAUST AND SUPPLY AIR FANS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with Division 1 - General Requirements and referenced documents.

B. Comply with all other Division 23 Sections, as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.2 SYSTEM DESCRIPTION

A. Provide exhaust fans of the type, rotational speed, and arrangement indicated.

B. Each fan shall be rated to deliver the capacity indicated in the tabulation on the Schedule against the external resistance of the system in which it operates.

C. Provide high efficiency motors as specified in Section 23 05 13 for motors one (1) horsepower and larger.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality.

B. All equipment and materials shall be installed by experienced mechanics and as recommended by the fan manufacturer.

C. All fans shall bear the AMCA and U.L. Labels. Capacity ratings shall be based on tests performed in accordance with the latest version of AMCA Standard 210 and Publication 211.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions together with fan curves.

B. Shop Drawings: Submit in accordance with Section 23 05 00.

C. When equipment, other than specified, is proposed, the Contractor shall be completely responsible for electrical revisions necessitated. Submit listing of electrical feeder and conduit sizes, breaker sizes, and motor starter sizes for each item of equipment where motor sizes are required to be larger than specified to meet scheduled capacities.

1.5 PRODUCT HANDLING

A. Cover and protect fans in transit and at site. Fans not properly protected and stored and which are damaged or defaced during construction shall be rejected. Cover all openings to prevent entrance of dirt and debris until final connections are made.

B. Storage and protection of materials shall be in accordance with Section 23 00 00.

PART 2 - PRODUCTS

2.1 FANS - POWER ROOF VENTILATORS (PRV-DOME AND UPBLAST TYPE)

A. Fans shall be direct drive, down blast or up blast type, units as indicated, positively ventilated, permanently lubricated, have sealed motors and fan shafts with ball bearings. Direct drive fans shall have ECM type motors with manufacturer furnished micro-drives or motor speed controllers to allow for balancing.

B. Provide centrifugal all aluminum fans with static and dynamic balance and with capacities as scheduled on drawings, all tested, approved, rated and bearing the AMCA Seal of Approval.

C. Provide all aluminum weatherproof housing, venturi throat inlet, bird screen and disconnect. Provide for concealed wiring such that power wiring does not penetrate roof but runs within curb.

D. Curbs shall be minimum twelve inches (12") high, made of galvanized steel and be insulated with minimum 1-1/2", 1-1/2 PCF density insulation, have continuous perimeter treated wood nailer and be furnished with a neoprene isolation strip to be placed on the top of the nailer. Provide sloped bottom of curbs to match roof pitch to allow for fans to be installed level.

E. Furnish automatic backdraft dampers for all fans, unless indicated otherwise. Only up blast grease exhaust models will not have backdraft dampers.

F. Provide SCR fan speed controller on direct drive motors with minimum stop for motor protection to be factory mounted on unit to be used for final air balance purposes.

G. Acceptable manufacturers:

1. Loren Cook.
2. Greenheck.
3. ACME.
4. Penn.
5. FloAire.
6. Twin City Fans and Blowers.

2.2 CEILING CABINET EXHAUST FAN

A. Provide in-line type ceiling cabinet exhaust fans with the capacities and characteristics scheduled.

B. Fans shall be AMCA certified and bear the label thereof.

C. Casing shall be made of galvanized steel and acoustically insulated for quiet operation. Housing shall be installed to provide for accessibility and removal of motor and blower without removing housing from the system.

D. Motors shall be permanently lubricated and have accessible internal wiring. Provide permanent split capacitor (PSC) motors. Provide external toggle disconnect switch with each fan.

E. Provide noiseless backdraft damper integral with unit.

F. Provide SCR fan speed controller with minimum stop for motor protection to be factory mounted on unit to be used for final air balance purposes.

G. Provide flat roof caps of the sizes indicated for each fan. Each cap shall be a minimum of eight inches (8") in diameter and shall be the curb mounted type to ensure proper flashing. Curbs shall be minimum twelve inches (12") high, made of galvanized steel and be insulated with minimum 1-1/2", 1-1/2 PCF density insulation, have continuous perimeter treated wood nailer and be furnished with a neoprene isolation strip to be placed on the top of the nailer. Provide sloped bottom of curbs to match roof pitch to allow for roof caps to be installed level.

H. Acceptable manufacturers:

1. Loren Cook Gemini.
2. ACME Masterette.
3. Greenheck SP/CSP.
4. Penn Zephyr.
5. FloAire.
6. Twin City Fans and Blowers, T or TL series.
7.

2.3 CENTRIFUGAL INLINE FANS

A. Provide centrifugal in-line fans where indicated to meet the capacity requirements scheduled.

B. In-line belt, or direct driven, centrifugal fans shall consist of a square steel housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

C. Housing: Heavy gauge steel with primer and final enamel coats of paint, or galvanized steel, inlet and outlet flanges, support bracket adaptable to floor, side wall, or ceiling mounting, and access panels.

D. Direct-Drive Units: Motor encased in housing out of air stream, factory-wired to disconnect located on outside of fan housing.

E. Belt-Drive Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and heavy duty lubricated and permanently sealed, pillow block type fan bearings. Motor and drives shall be out of air stream. Drives to be sized for 150% of motor horsepower.

F. Wheel: Aluminum, centrifugal blower, with non-overloading blades and tapered inlet. Wheel shall be statically and dynamically balanced.

G. Accessories: The following accessories are required as indicated:

1. Companion Flanges: For inlet and outlet duct connections.
2. Fan Guards: Expanded metal in removable frame.
3. Speed Control: For direct drive units, provide a variable speed switch with on-off control and speed control for 100 to 50 percent of fan air delivery.
4. Disconnect switch unit mounted.

H. Fan wheel, bearings, shaft, and drive components shall be serviced or removed without disturbing ductwork connections. Access doors shall be hinged or fully removable.

I. Blower assembly shall bear the AMCA seal of approval for both air and sound.

J. Acceptable manufacturers:

1. Loren Cook.
2. Acme.
3. Greenheck.
4. FloAire.
5. Twin City Fans and Blowers.

PART 3 - EXECUTION

3.1 DELIVERY AND PROTECTION

A. Deliver all equipment to the site as indicated in Division 1.

B. Contractor to perform installation and start-up to include installation of all accessories as required to make a complete and operating system.

C. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost to the Owner.

3.2 EXHAUST FANS - INSTALLATION

A. Install fans level on roof curbs, suspended from structure, or as indicated, and provide vibration isolation internally or externally as required, as specified herein, or as specified in other sections of these specifications.

B. Suspended fans shall be set level with all thread rod from structure above.

C. For fans installed in wall sleeves secure fan to wall sleeve with non-ferrous corrosion resistant fasteners and seal watertight.

D. Field install motor and other accessories not factory installed.

E. Verify operation of automatic motorized and backdraft dampers.

F. Adjust fan drives and replace sheaves as required to obtain scheduled capacities as directed by the Test and Balance firm.

3.3 ROOF MOUNT CURBED EXHAUST FANS

A. Install all roof mounted exhaust fans on the factory fabricated and insulated roof curbs. Flash and counterflash to prevent leakage.

B. Mount fan base on neoprene strips on curb tops.

C. Secure fan base to curb with non-ferrous fasteners.

D. Field install motor and other accessories not factory installed.

E. Verify operation of backdraft and motorized dampers.

F. Adjust fan drives or replace sheaves as directed by the Test and Balance Firm to obtain scheduled capacities to and as required to meet field conditions.

3.4 CLEAN-UP

A. Clean all fans and components after installation is complete.

B. Vacuum clean all debris from inside scrolls, on fan wheels and at drives.

END OF SECTION

SECTION 23 43 23

POLAR IONIZATION AIR PURIFICATION SYSTEMS

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. Comply with Division 1 – General Requirements and reference documents.

B. Comply with all other Division 23 Sections, as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.02 SYSTEM DESCRIPTION OF WORK

A. Provide bi-polar ionization air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

B. Each ionization array shall be "Needlepoint" type array.

1.03 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality.

B. All equipment and materials shall be installed by experienced mechanics and as recommended by the manufacturer.

C. All cold plasma arrays shall be UL 86-2007 tested and U.L. listed. The technology shall have been tested to DO-160 by an independent lab and successfully passed all requirements for shock, vibration, EMF and line noise. Manufacturers not tested to DO-160 shall not be acceptable.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
3. Performance data for each type of plasma device furnished.
4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
5. Product drawings detailing all physical, electrical and control requirements.

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.06 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from owner acceptance, whichever is longer.

PART 2 - PRODUCTS

2.01 BI-POLAR IONIZATION GENERATORS

A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.

B. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

C. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
3. Capable of reducing static space charges.
4. Effectively reducing space particle counts.
5. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:

a. MRSA - >96% in 30 minutes or less
b. E.coli - > 99% in 15 minutes or less
c. TB - > 69% in 60 minutes or less
d. C. diff - >86% in 30 minutes or less
e. Noro Virus -> 93.5% in 30 minutes or less

D. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable. Ionizers with positive and negative output (DC type) shall not be acceptable. All ionizers provided shall be AC type ionizers with one electrode pulsing between positive and negative.

1. Air exchange rates may vary through the full operating range of a constant Volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have maximum velocity profile.

E. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

F. Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):

a. Each alternating current (AC) Ionization Bar or module with Bi-polar Ionization output shall include type 316 medical grade stainless steel ion needles. The plasma electrode shall require no more than one inch in the direction of airflow for mounting. All hardware required for mounting shall be provided by the air purification manufacturer except self tapping screws for the power supply. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction

over time, ozone production and corrosion. Plasma generators and bars with recessed needles shall not be acceptable.

b. Electrodes shall be energized when the main unit disconnect is turned on.

c. The ionization output shall be a minimum of 35 million ions/cc per inch of cooling coil width as measured 1 inch from the cold plasma needles.

d. Ionization bars shall be provided with magnet mounting kits to prevent penetration into cooling coils.

G. Duct Mounted Units:

1. Where so indicated on the plans and/or schedules Polar Ionizer(s) shall be supplied and installed. The mechanical contractor shall mount the Ionizer in the supply air ductwork downstream of the unit and any associated storm baffles. It shall be wired to the packaged Roof-Top AC unit control power supply with 24V AC input. Each Polar Ionizer shall be designed with an aluminum casing, liquid tight flexible conduit and a quick connector. Where required, multiple modules shall be wired together for higher airflow capacity units.

H. Plasma Requirements:

1. Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.

a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 24V AC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.

b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced (AC Ionizers only are acceptable). Imbalanced levels shall not be acceptable.

c. Ionization output from each electrode shall be a minimum of 35 million ions/cc when tested at 1” from the ionization generator. The ionization bar shall provide 35 million ions/cc per inch of bar over the entire width of the ionization bar. Bars with needles spaced further apart will not be acceptable.

2. Ozone Generation:

a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation.

I. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24V AC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

J. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.
2. The ionization system shall be provided with a stand-alone, independent ion sensor designed for duct mounting to monitor the ion output and report to the BAS system that the ion device is working properly. The control voltage to power the ion sensor shall be 12VDC or 24VAC and draw no more than 30mA of current at 12V DC. The sensor shall provide dry contact status to the BAS.
3. The installing contractor shall mount and wire the Plasma device in the supply duct approximately where shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.
4. A fiberglass NEMA 3R panel with Plasma On/Off Indicator Light (interfaced with stand-alone ionization detector), Ionization Output On/Off Indicator Light and an On/Off Illuminated Switch shall be provided to house the power supply.

K. Acceptable Manufacturers:

1. Global Plasma Solutions.
2. Plasma Air.

PART 3 - EXECUTION

3.01 DELIVERY & PROTECTION

A. Deliver all equipment to the site as indicated in Division 1.

B. Contractor to perform installation and start-up to include installation of all accessories as required to make a complete and operating system.

C. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost to the Owner.

3.02 TESTING

A. Provide the manufacturers recommended electrical tests.

3.03 COMMISSIONING & TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

SECTION 23 81 27

DUCT-FREE SPLIT SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with General Requirements in Division 1, and all referenced documents.

B. Comply with all other Sections as applicable.

1.2 SYSTEM DESCRIPTION

A. The work shall include installing remote air cooled heat pump condensing units and duct-free split system direct expansion (DX) evaporator fan coil units where indicated on the Drawings to meet scheduled capacities. Heat pumps shall be matched with indoor unit coils.

B. Contractor shall connect all refrigerant piping, refrigerant specialties, required controls, starters, field installed accessories, appurtenances, insulation, hangers, supports, foundations, etc. to make a complete and operational system.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality, complying with all standards specified herein.

B. All equipment and materials shall be installed by technicians trained to perform this type of work, having had experience with similar type of equipment, and shall be in full accordance with the recommendations of the manufacturer.

1.4 SUBMITTALS

A. Product Data: Submit complete manufacturer's descriptive literature, installation instructions, wiring diagrams, electrical characteristics at the scheduled voltage and phase, piping connections, and matched capacity ratings at specified conditions, accounting for proposed refrigerant line size, routing and length of run. Indicate all accessories furnished, sizing of refrigerant piping, and other descriptive literature to verify conformance to these specifications.

B. Submit system piping schematic with recommended pipe sizes, piping routing, fittings, and proposed equipment configuration.

C. Submit in accordance with Division 1.

1.5 PRODUCT HANDLING

A. Cover and protect material in transit and at site. Material not properly protected and stored and which is damaged or defaced during transit or storage shall be rejected and replaced at no cost.

B. Storage and protection of materials shall be in accordance with General Requirements and Division 1.

1.6 INSTALLATION, OPERATING, AND MAINTENANCE MANUALS

A. Furnish all installation manuals required by an experienced and trained technician for proper installation of equipment. Manuals shall be provided with equipment and be attached thereto.

B. Furnish three (3) copies of operations and maintenance brochures, including spare parts list, at "Substantial Completion".

PART 2 - PRODUCTS

2.1 DUCT-FREE SPLIT SYSTEM FAN COIL UNITS

A. Furnish and install Duct-Free Split System Fan Coil Units as indicated and located on the Drawings. Equipment shall be of capacities, characteristics, sizes, etc., as indicated and scheduled on the Drawings, with the following features:

1. Microprocessor controls.
2. Self-diagnostics, including compressor drive, indoor fan, and reversing valve malfunction tests.
3. Restart function for automatic start after a power failure.
4. Automatic air sweep.
5. Mounting bracket and template.
6. 3-Speed fan motor.
7. Easy-to-remove cleanable filters; minimum one inch (1") thick
8. Accessories, as scheduled.
9. Electric heat strip, as applicable.
10. Wall mounted wired thermostat supplied by manufacturer. Non-wired hand-held remote not acceptable.
11. Built-in condensate pump with reservoir (when scheduled) and sturdy high-low float switches and an overflow float switch to turn the A/C unit off. Separate external pump with separate 120/1 volt power requirement **not allowed**.

B. Units shall be as manufactured by:

1. Mitsubishi
2. Lennox
3. Daikin
4. LG.
5. Carrier.

2.2 AIR COOLED HEAT PUMP

A. Furnish air cooled heat pump as scheduled. Brass service valves with refrigerant line fittings and service ports shall be located in the exterior of the unit. The unit shall be properly assembled and tested at the factory. It shall be designed for use with Refrigerant R-410A. Units shall be as manufactured and matched to the indoor unit.

B. Performance: Capacities shall be as scheduled, to be combination ratings for matched indoor coil and outdoor condensing unit installation shown including accounting for refrigerant line losses.

C. Condensing coils shall be made of copper tubes with aluminum fin construction and shall be warranted for 5 years. Coils shall have aluminum plate fins, mechanically bonded to the coil tubes. Coils shall be provided with the manufacturer's furnished, field or factory installed, condenser coil air inlet hail and vandal guards. Hardware cloth or flat expanded metal is not acceptable. Guards shall be baked enamel painted steel, PVC coated steel or other approved corrosion resistant metal.

D. Condenser Fans and Motors: Units shall be furnished with direct driven, propeller-type fans. Condenser fan motors shall have inherent protection, and shall be of the permanently lubricated type, resiliently mounted. Each fan shall have a corrosion resistant metal safety guard.

E. Compressor shall be of the welded-hermetic type with internal vibration isolation. Compressor motor shall have both thermal and current sensitive overload devices. Start assist (capacitor type) device shall be standard on single phase units if the refrigerant piping is over 50 feet in total length. Compressor shall be equipped with a crankcase heater and have internal high pressure protection.

F. Controls and protective devices shall include a liquid line low- pressure switch, manual reset high pressure switch, suction line accumulator and pressure relief device. Control wiring terminal board shall be designed to match indoor unit terminal board and accessory thermostat terminals for standardized point-to-point connectors. An automatic defrost control shall be included to accomplish defrosting (only if coil saturated suction temperature indicated freezing temperatures) every 90 minutes for a period of not more than 10 minutes.

G. Accessories shall include Solid-State Time Guard, Liquid Line Filter Dryer, sight glass, Flare-To-Compatible Coupler, and a head pressure controller to allow operation down to 20 Deg.F. ambient temperature.

H. The air cooled heat pump shall carry the full one year parts and labor warranty on the entire unit, plus, an additional four year parts only warranty on the motor compressor unit.

I. All heat pumps shall have a minimum 15 SEER (ARI) at combination rating with matched DX-coil.

J. Units shall be as manufactured by:

1. Mitsubishi
2. Lennox
3. Daikin
4. LG.
5. Carrier.

K. EXECUTION

2.3 DELIVERY AND PROTECTION

A. Deliver all equipment to each site. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost.

B. During construction, take all steps necessary to protect equipment from damage or vandalism. All damage or vandalism shall be repaired at no cost to the Owner.

2.4 AIR COOLED HEAT PUMP AND FAN COIL UNIT INSTALLATION

A. Install heat pump level on roof supports pads where shown with vibration pads.

B. Route refrigerant piping and make connections to DX coils as recommended by the unit manufacturer.

C. Furnish and install all refrigerant piping specialties including, but not limited to, thermal expansion valves, sight glasses, and filter dryers.

D. Furnish and install all factory furnished accessories not factory installed.

E. Charge all refrigerant piping systems and equipment to maintain a fully operating refrigerant charge.

F. Verify correct power and control wiring installation. Measure operating voltage and current, check proper rotation of motors, and verify correct settings of safety devices and controls.

G. Clean indoor and outdoor coils, including dust and lint, clean condensate pan on each fan coil unit section after the evaporator coil is clean.

H. Install new filters as specified in other sections of these specifications. Refer to Section 23 30 00.

2.5 REFRIGERATION PIPING

A. Piping shall be Type "K" copper, ACR cleaned and capped. All fittings shall be long radius and shall be cleaned and de-greased before use.

B. Refer to Section 23 23 00, Refrigerant Piping.

2.6 OPERATING PROCEDURES AND REQUIREMENTS

A. Operating and service instructions, three (3) copies, in illustrated and bound form shall be furnished by the manufacturer at "Substantial Completion".

B. At startup, the equipment manufacturer shall furnish skilled personnel to supervise, check out performance, make any required adjustments, place all units in service, and instruct the Owner's personnel for a full period of two (2) hours.

C. The manufacturer of each item of equipment shall provide complete wiring diagrams to the Electrical Contractor and shall provide drawings indicating all required external wiring and arrangements of connections.

2.7 WARRANTY

A. Transfer Warranty to Owner for a full one year period after "Substantial Completion".

B. Transfer any and all other warranties as applicable over to the Owner at "Substantial Completion", including extended 4-year compressor warranties, as applicable, on refrigeration equipment.

END OF SECTION

SECTION 23 81 33

SEMI-CUSTOMIZED ROOFTOP AIR CONDITIONING UNITS (GAS - ELECTRIC)

(3 TONS AND ABOVE)

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with General Requirements in Division 1 - General Requirements, and all referenced documents.

B. Comply with all other Division 23 Sections as applicable. Refer to other Divisions for coordination of work with other trades as required.

1.2 SYSTEM DESCRIPTION

A. The work shall include installing new specialty semi-customized electric cooling gas heating roof mounted air conditioning units to meet scheduled capacities and to effect outside air control by modulation and space relative humidity control.

B. Contractor shall connect all ductwork, condensate drain piping, gas piping, roof curbs, temperature controls, power supply, disconnects, factory furnished field installed accessories, appurtenances, insulation, supports, flashing, etc. to make a complete and operational system.

1.3 QUALITY ASSURANCE

A. All equipment and materials shall be new and of the best quality complying with all standards specified herein.

B. All equipment and materials shall be installed in a workmanlike manner by trained and experienced mechanics as recommended by the equipment manufacturer and as detailed on the Drawings.

C. Units shall be rated in accordance with ARI Standards 210/240 or 360 and 270, as applicable, and be capable of starting and running at ambient outdoor temperatures as high as 115 Deg. F. while operating to meet the maximum load requirement.

D. Units shall be designed to conform to ASHRAE Standard 15, latest revision.

E. Units shall be U.L. Tested and Certified in accordance with ANSI Z21.47 Standards as a total package for safety requirements.

F. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

G. Unit casings shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500 hour salt spray test.

H. Each individual unit shall be subjected to a completely automatic factory run test on the assembly line. Each unit shall pass this run test, repair as necessary, prior to being allowed to be shipped to the project site.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation instructions and method for the configuration of equipment proposed, including wiring diagrams, piping connections, ductwork connections, capacities at scheduled conditions, fan capacity curves, accessories furnished, and other

descriptive literature necessary to fully evaluate the Submittals for full compliance with these specifications.

B. Shop Drawings: Submit in accordance with Sections 01 33 23 and 23 05 00.

1.5 PRODUCT HANDLING

A. Deliver all equipment to the site where it shall be covered and protected. Material not properly protected and stored and which is damaged or defaced during construction shall be replaced at no cost to the Owner.

B. Storage and protection of materials shall be in accordance with Section 23 05 00.

1.6 INSTALLATION, OPERATION, AND MAINTENANCE BROCHURES

A. Furnish all installation manuals required by a trained and experienced mechanical technician for proper installation of equipment. Manuals shall be provided with equipment and be attached thereto, or contained therein.

B. Furnish three (3) complete bound Operating and Maintenance Brochures with spare parts lists, which shall be submitted at "Substantial Completion".

C. At project close-out, furnish an extended four (4) year compressor and fourteen (14) year heat exchanger warranty certificates to begin at the end of the first year warranty. The first year Warranty begins at Substantial Completion. Indicate specific model and serial numbers for all items of equipment furnished to be warranted.

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP A/C UNITS

A. Packaged Rooftop Units shall be factory assembled, tested, piped, internally wired and shipped in one piece complete with an operating charge of refrigerant and oil. Units shall be direct expansion cooling, natural gas heating, with downflow discharge mounted on a full perimeter roof curb. Packages shall be complete with all operating and safety controls. All units shall be factory test run in the cooling and heating modes with the following items being monitored for each individual unit:

1. Amperage for each electrical component.
2. Refrigerant suction and discharge pressures with corresponding ambient temperatures and relative humidity.
3. Gas flow rate to burners.
4. Verify operation of all safeties by simulating condenser fan and evaporator blower failures.
5. Provide all test information along with a wiring diagram and a maintenance and operation manual inside each unit.

B. Cooling capacities shall be rated in accordance with A.R.I. standards. Capacities scheduled are gross capacities. Net capacities include deductions of fan motor heat. Submittals must show both gross and net capacities.

C. Unit casings shall be constructed of phosphatized G90 galvanized steel with factory baked acrylic-epoxy paint or bonderized and coated baked enamel finish in beige color on all exposed surfaces. All assembly screws shall be zinc-chromate coated. Unit shall be equipped with factory installed lifting or rigging lugs.

1. Access to compressors, controls, filters, fan motor and other items needing periodic checking or maintenance shall be through:

   a. Hinged access panels on units from 3 to 12 tons in size.
   b. Double wall hinged access panels on sizes over 12 tons.

2. Blowers shall be made accessible by:

   a. Removable panels on units 3 to 6 tons in size.
   b. Double wall hinged access panels on units over 6 tons in size

3. Air side service access doors shall be fully gasketed with rain break overhangs, and these doors shall have a metal liner to protect insulation. All interior surfaces in contact with the air stream shall have one inch (1") mat-faced fiberglass insulation. The unit casing shall be assembled in such a manner to be waterproof and provide for natural drainage. The unit base shall be watertight and constructed with 14 gauge load bearing members. Cabinet insulation shall meet ASHRAE Standard 62P and shall generally have 1.5 pound density with foil face coating used where exposed to the airstream in the heating section. The unit shall have a factory provided entry way within the cabinet for all wiring to enter from below within the confines of the full perimeter roof curb.

D. All units shall be provided with direct drive fully hermetic, or semi-hermetic, single, two-stage, or digital (Aaon only) type compressors. Compressors shall be factory rubber-shock mounted for optimum vibration isolation. Provide an oil level sight glass, oil charging valve, and two points of lubrication on semi-hermetic compressors. Provide refrigerant strainers, filter drier, and service gauge connections on the suction, discharge, and liquid lines for all compressors. High strength non-flexing ring type suction and discharge valves shall be provided. Compressor motors shall be suction gas cooled, be provided with a crankcase heater and have a voltage utilization range of plus or minus 10% of name-plate. Two winding thermostats shall be imbedded between the motor windings for semi-hermetic compressors. Scroll compressors shall have only one internal thermal protection device per winding. Any thermal overload in any single winding will be detected and alarm internal to the unit controls. Standard safety controls shall include high and low pressure cutouts, oil pressure cutouts (semi-hermetic compressors only), loss of charge protection, compressor reverse rotation protection (scroll compressors only), freeze protection, line break thermal and current overload protection, and reset relays. System shall have liquid line driers and shall be fully charged with R-410a. The first stage compressor on all units shall have a factory installed humidity control feature such as the Lennox “Humiditrol” unit with hot gas reheat coils. All units larger than 7 tons shall have a minimum of 2 compressors without exception. Multiple compressor units shall be furnished with independently mounted circuits. Compressors shall be capable of operation down to 40 Deg. F. ambient outdoor temperatures. In lieu of hot gas re-heat, units with digital scroll compressors on first stage compressor shall be allowed. All units 3 to 5 tons shall have two-stage or digital scroll type compressors.

E. Evaporator coils shall be constructed of seamless copper tubing mechanically bonded to heavy duty aluminum fins.

1. All cooling coils shall have galvanized steel end casings and equalizing type vertical tube distribution with a top suction connection.
2. Cooling coils shall generally have a minimum of 4 rows. Fins shall not exceed 15 fins per inch.
3. Coils shall be equipped with a thermostatically controlled expansion valve. Multi-compressor units shall be circuited with one circuit and one expansion valve per compressor.
4. Multiple circuits shall be intertwined in the evaporator coil. Single evaporator coils may be either the full face active design or be the face split design.
5. Each unit shall be equipped with a 5 minute anti-short cycle delay timer, or equivalent control strategy used for compressor protection, for each compressor.
6. Coils shall be factory pressure and leak tested at a minimum of 300 PSIG.

F. Provide sloped condensate drain pans. Pans shall be sloped in two directions for positive drainage to meet ASHRAE Standard 62. Pans shall be fabricated with Type 304 stainless steel, be minimum 18 gauge in thickness and shall have all welded joints. Alternately, condensate pans can be made of a heavy duty plenum rated plastic material.

G. Condensing coils shall be fabricated of seamless copper tubing with configured aluminum fins mechanically bonded to tubing. Condenser coil shall be designed for a minimum of 10 Deg. sub-cooling.

H. Coils shall be factory tested to 450 PSIG air pressure and then vacuum dehydrated. Provide condenser fin hail and vandal guards. Guards shall be made of hot dip galvanized steel; or UV inhibited, PVC coated steel; or factory enamel or epoxy painted steel; or other approved corrosion resistant material. Flat expanded metal, field made devices, and screen or fencing materials are not acceptable.

I. Outdoor condenser fans shall be vertical discharge, direct drive type, propeller fans. Fans shall have aluminum or steel blades and zinc plated steel hubs which shall be statically and dynamically balanced. Motors shall have permanently lubricated ball bearings, built in current and automatic reset thermal overload protection and weather-tight slingers over bearings. Provide a corrosion resistant metal, or PVC coated steel, fan guard.

J. All supply air fans shall be direct drive, double inlet, forward curved fans with adjustable sheave drives. Fan motors 1 HP and larger shall be the premium efficiency type that are furnished as a standard option by the unit manufacturer. Refer to Specification Section 23 0513 for general requirements on these motors. Where non-standard motor frames, under 5 HP in size, are the standard motor offered by the unit manufacturer and where these motors are exempt from meeting the EPACT requirements, these motors are not required to be the premium efficiency type. Motors shall have permanent lubricated bearings. Fans shall be statically and dynamically balanced. Fan bearings shall be self-aligning, grease lubricated, ball or roller bearings, of the pillow block type with 200,000 hour bearing design, easily accessed for servicing. Fan wheels shall be constructed of aluminum or steel and be coated with a corrosion resistant finish. Provide optional/alternate motor and drive assembly to produce the design CFM and external static pressure scheduled where required based on scheduled requirements.

K. Outside air shall be controlled by an optimized dry-bulb economizer with multi-stage integrated economizer and compressor operation for optimum energy efficiency.

1. The economizer shall consist of a motor operated fully modulating type outdoor and return air dampers, both sequenced and fully adjustable, constructed from low leakage dampers that utilize metal blades with rubber edge seals and aluminum or stainless steel end seals. Damper blades shall be gear driven and be designed to have no more than 25 CFM of leakage per square foot of damper area when subjected to 2" W.G. air pressure differential across the damper, or less than 2% at a total static pressure of 0.5 Inches W.G., with a negative return air static pressure of 0.05 Inches W.G.
2. Damper motors shall be the spring return type to insure the tight closing of the outdoor air damper during periods of unit shut down or power failure. The outside air damper and actuator shall be capable of opening to a pre-set minimum when the unit is operated in the normal occupied mode. Provide a field adjustable end switch, or equivalent control feature such as a potentiometer or SCR, to allow minimum outside air adjustment to that as scheduled.
3. A pressure relief damper sized for 100% relief air shall be provided as part of the economizer.
4. The economizer shall be completely factory installed, wired and run tested.
5. For units 10 tons in capacity and larger furnish a powered exhaust relief as a part of the economizer package.
6. Damper actuators shall be compatible with a standard pulse width modulated (PWM) Energy Management System output signal to allow modulating control of the minimum outside air flow rate for return air carbon dioxide level control, whether utilized or not. Actuators shall be a Belimo MFT type actuator.
7. Provide weather protected hoods over each outside air intake and relief air outlet. Provide protection from birds on all hoods, using galvanized steel bird screen (1/2" x 1/2" wire mesh) or other approved method.

L. Heating Section:

1. Induced draft power combustion type with energy saving electronic direct spark ignition system and induced draft direct drive centrifugal blower with an electric differential pressure switch to lock out the gas valve until the combustion chamber is purged and combustion air flow is established. Induced draft combustion motor shall have permanently sealed bearings and inherent automatic-reset thermal overload protection.

2. Heat exchanger shall be of the tubular section type constructed of heavy gauge stainless steel for enhanced corrosion resistance.
3. Burners shall be of the in-shot type designed to use natural gas and be equipped with a gas valve and combustion blower. Two to four stage type gas furnaces shall have redundant dual gas valves. Heating control shall be initiated by a 0-10 Vdc signal from a DDC Control System or other signal compatible with the Energy Management System provided and the control sequences specified elsewhere herein.
4. All gas piping shall enter the unit cabinet at a single location.
5. Provide flue up discharge deflector where an option exists with the manufacturer.
6. Unit tubular stainless steel gas heat exchangers shall carry a 15-year non pro-rated warranty starting at "Substantial Completion".
7. Furnace section shall have foil faced insulation on the air side of the casing.
8. Heating section controls shall also consist of a redundant main gas valve, associated time delay relays, limit switches, centrifugal switch, high temperature limit switch, flame rollout switch and flame proving controls.

M. Furnish two inch (2") filter racks with two inch (2") thick pleated media filters shipped with the unit, 30% efficient, equal to Camm-Farr 30/30 filters. Both return and outside air shall be filtered by the same filter bank. Filters shall be provided in a large enough quantity to limit the actual face velocity to no more than 375 feet per minute. Filters shall be one standard commercially available size. Filters shall be accessible without the use of tools. All replacement filters and those installed at the time of Testing, Adjusting and Balancing (TAB) shall be provided and installed as specified in Specification Section 23 3000 and be rated at a MERV 11.

N. Roof curbs shall be minimum 18" in height (where not on storm shelter) and minimum 24” in height (where on storm shelter) and be constructed of minimum 18 gauge G-90 galvanized steel. Curbs shall be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curbs shall provide for the full support for both the supply and return air ducts. Provide manufacturers standard knock down style curbs with hinged corners. Provide for a separate thru utility vertical entry point within the footprint of the inside of the curb; no penetrations allowed in the side (vertical portions) of curbs. Curbs shall be fully perimeter insulated with minimum one inch (1") thick neoprene coated rigid fiberglass insulation, minimum 1.5 pcf density, either factory or field insulated. Provide a 2" x 4" treated wood nailer strip around the full perimeter of the curb. All curbs shall be built to meet the National Roofing Contractor Association (NRCA) requirements. Provide curbs that are pitched to match the roof slope, from 1/4" to 12" pitch, so that the rooftop unit sits level above the roof and to allow positive drainage of condensate. Provide custom curbs where required to allow for ductwork transition in curb above roof for storm shelter and to encapsulate ductwork inside roof curb.

O. Units shall have a factory installed and wired non-fused disconnect. Additionally, provide a non-powered weatherproof 10 amp capacity, 115 volt, GFCI, duplex service receptacle inside the control compartment, or on the exterior of the cabinet, for each unit where designated on the Drawings. Receptacle power supply shall be supplied from within the unit, single point power supply. Should the Manufacturer have added ampacity and overload protection requirements beyond the scheduled requirements as a result of this feature the unit manufacturer shall be responsible for all related electrical changes and costs to make these changes.

P. All roof top A/C Units shall have minimum ARI, EER or SEER and furnace AFUE efficiencies as scheduled, each of which shall meet or exceed that required by the latest version of the International Energy Conservation Code.

Q. Factory mount and wire terminal equipment controllers furnished under this section. Operating controls shall include the following:

1. Each unit shall have a minimum of two (2) stages of heating and cooling on all units over 7 tons in size. For units 7 tons and smaller, single stage heaters and two (2) stages of cooling shall be suitable.

2. Provide a Conventional Thermostat Interface (CTI) with wiring terminals provided by the unit manufacturer to allow for the interface and control of the number of stages of heating and cooling and the supply fan.
3. Integrated controls shall be furnished by the equipment manufacturer on the unit at the factory under this Section of the Specifications. Controls shall be suitable for field wiring of other temperature control related sensors and accessories furnished under Section 23 09 00. Fully coordinate all control items between both of these Sections of Specifications
4. Each cooling system will also incorporate a dehumidification and refrigerant cycle reheat capability to control space relative humidity to no higher than 60% R.H., adjustable. Sensible cooling shall take priority over the dehumidification mode, and this shall be determined internal to the unit, via, an external 0-10 VDC control signal which shall equate to the space relative humidity level. At the option of the Energy Management System supplier, this can be emulated through the local unit controller. Fully coordinate the method used with all trades involved.
5. The integrated gas controller (IGC) diagnostics board shall include gas heat operation fault notification using a LED (light-emitting diode). Each unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch, or three continuous short cycles on the high temperature limit switch. Fault indication shall be made using an LED. The IGC board shall contain algorithms that modify evaporator fan operation to prevent future cycling on high temperature limit switch. LED display shall be visible without removal of control box access panel.

R. All refrigeration systems shall use an EPA approved refrigerant that will be readily available in the commercial market for the next 10 years under current legislation and protocols. R-410a is the preferred refrigerant to be used. All units furnished on a project shall all utilize the same refrigerant.

S. Unit electrical connections shall consist of suitable openings in the cabinet for routing of all utility connections within the roof curb to include through-the-bottom power supply connection. The base unit shall contain a terminal strip in the control compartment to allow for terminal-to-terminal connection of roof thermostat (temperature sensor) and field installed accessories. Electrical controls shall be complete with self-contained low voltage control circuit protected by an automatic reset device. All unit power wiring shall enter the cabinet at a single factory pre-drilled location designed for single point electrical service. Unit voltages shall be as scheduled.

T. Units shall be as manufactured by:

1. Lennox, Emergence with “Humiditrol” dehumidification feature.
2. Aaon with digital scroll compressors.
3. Trane, with hot gas re-heat.
4. Daikin, with hot gas re-heat.
5. Carrier, with humidimizer type feature.

2.2 TEMPERATURE CONTROLS

A. Under Specification Section 23 0900, Controls and Instrumentation, space temperature, relative humidity, and carbon dioxide sensors, as applicable, shall be provided for field installation along with factory mounted and wired terminal unit controllers to control units. Only designated units shall have carbon dioxide sensors.

B. Each rooftop A/C unit shall have wiring terminals to receive signals from the Terminal Unit controller to receive CTI or PWM, as applicable, signals to stage on and off heat, energize compressor(s), energize hot gas reheat sequence, control the economizer cycle, and modulation of the outside and return air dampers for space carbon dioxide level control. Provide contacts to energize and de-energize the unit.

PART 3 - EXECUTION

3.1 DELIVERY AND PROTECTION

A. Deliver all equipment to each site. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt.

B. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost.

C. During construction, take all steps necessary to protect equipment from damage or vandalism. All damage or vandalism shall be repaired at no cost to the Owner.

3.2 ROOFTOP A/C UNITS

A. Install manufactured roof curbs on the roof square and level to receive the units. Provide and install additional steel framing as required to provide safe, noiseless, operating systems. Locate units with condensate drain pans sloped for positive pan drainage.

B. Coordinate the electrical services and control wiring with the Electrical Systems Installer. Coordinate the condensate drainage system with the Plumbing Systems Installer. The manufacturer of each item of equipment shall provide complete wiring diagrams to the Electrical Systems Installer and shall provide drawings indicating all required external wiring, piping and arrangement of all field connections.

C. Coordinate the exact unit locations with the structural systems and the ceiling systems below as actually installed. Shim roof curbs, or adjust as applicable, to make entire top of each curb level.

D. Make all sheet metal supply and return duct connections with flexible duct connections below the roof.

E. Install sound and vibration isolation devices as detailed on the Drawings. Install continuous 2" wide by 3/8" thick neoprene isolation strip along the full perimeter of the roof curb for a complete air seal.

F. Provide for one (1) additional set of fan sheaves for each belt drive unit, as required by the Testing and Balancing Firm, to obtain design air flows. For bidding purposes provide one (1) set sheaves, and belts where required, as follows:

# of Units	Minimum # Sets of Belts & Sheaves
1 - 5	3
6 - 10	5
11 - 15	7
16 - 20	9
21 - 30	14
31 or more	33%

G. Gas furnaces shall be jumpered to operate at full fire, with the supply fan operating, for a minimum of thirty (30), but not more than sixty (60), minutes to burn off dust, lint, and factory produced oil films. Remove jumper after this process is completed. Perform this work in such a fashion as not to void equipment warranties. Documented factory run tests conducted for 30 minutes will be considered, but must be approved by the Engineer.

H. At start-up, have all units served by a gas pressure regulator, external to the units, operated at full fire, and adjust gas supply pressure to these units to be between 7-10 inches W.G. Document in writing actual pressure measure going into unit, as well as manifold pressure. Include this information in Start-up Report to be submitted with Close-Out Documents.

I. Verify all items internal to unit controlled by the terminal equipment controller functions when commanded to operate. Verify that all dampers fully modulate and that they close fully when commanded to be in that position.

J. Do not operate units without specified air filters being installed. Failure to do so will result in the Contractor cleaning coils at no cost to the Owner.

K. Tighten and align fan belts and lubricate all bearings. Verify proper rotation of moving parts.

L. Install all field installed accessories.

M. Make all power and control wiring connections.

N. Verify correct operation of equipment, accessories, and control devices.

3.3 CLEANUP

A. Clean evaporator and condenser coils, condensate pans and condensate drain piping after installation of rooftop A/C units is complete.

B. Clean all debris from inside rooftop A/C unit casings

C. Replace air filters with new as specified in Section 23 30 00.

3.4 OPERATING PROCEDURES AND REQUIREMENTS

A. Operating and service instructions in illustrated and bound form shall be furnished by the manufacturer, three (3) copies, at "Substantial Completion".

B. At startup, the equipment manufacturer shall furnish skilled personnel, separate from the installing contractor’s work force, to supervise, check out performance, make any required adjustments, place all units in service, and instruct the Owner's personnel for a full period of two (2) hours for each 15 units provided. Fill out a manufacturer’s start-up report, to be typewritten, for each new unit installed which shall reflect the operating conditions of the electrical power supply, refrigeration system and gas furnace.

3.5 WARRANTY

A. Transfer Full Parts and Labor Warranty to Owner for a full one (1) year period beginning at "Substantial Completion".

B. Transfer any and all other warranties as applicable over to the Owner at "Substantial Completion", including extended 4-year compressor warranties, as applicable, on refrigeration equipment and extended 14-year warranties on stainless steel heat exchangers.

END OF SECTION

SECTION 23 82 46

ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with General Requirements in Division 1, and all referenced documents.

B. Comply with all other Sections as applicable.

1.2 SYSTEM DESCRIPTION

A. Scope of work shall include furnishing and installation of electric unit heaters and accessories as indicated and specified herein.

B. All items of equipment shall meet or exceed scheduled capacities and shall be provided in quantities indicated.

1.3 QUALITY ASSURANCE

A. All work shall comply with the most recent edition, with amendments of the local Building Code, Mechanical Code, Plumbing Code, Fire Code, and all other state and local codes or ordinances.

B. All heaters shall be Underwriters Laboratory (U.L.) listed and shall be listed for the specific installation application.

C. All equipment installations shall be installed in accordance with the National Electrical Code (NEC).

D. The manufacturer of each type of equipment specified herein shall have a minimum of five (5) years operating experience with each heater type.

1.4 SUBMITTALS

A. Indicate equipment, materials, quantities, sizes, installation details and any other descriptive literature necessary to fully evaluate submittals for compliance with these specifications.

B. Provide power supply and control wiring diagrams suitable for use by an electrician and control wiring technician.

C. Shop Drawings: Submit complete shop drawings in accordance with Division 1 and Section 23 0500.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Damaged, deteriorated, or wet materials shall be rejected and replaced.

B. Take all measures necessary to protect equipment from damage or vandalism during construction. Any such damage discovered shall be cause for rejection of equipment, in which case the Contractor shall replace equipment at no cost to the Owner.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Provide electric unit heaters which shall be complete packaged units with controls and accessories as specified herein to meet scheduled capacities as indicated on the Drawings.

B. Units shall be furnished with a minimum 18 gauge, die formed, steel cabinet with a factory applied phosphate coating and baked enamel paint finish.

C. Each unit shall have a direct drive fan motor with axial flow propeller blade fan. Fan motor shall be permanently lubricated with sealed bearings and internal overloads. Motor shall be the totally enclosed type rated for continuous heavy duty all angle operation and equipped with built-in thermal overload protection. Fan speed shall not exceed 1600 RPM.

D. Electric heating elements shall be low temperature enclosed style metal sheath type. Elements shall be made of steel and monel and have a copper clad steel sheath and aluminum fins warranted for five (5) years. Elements shall have automatic reset thermal overload protection to shut down elements and fan if safe operating temperatures are exceeded.

E. Units shall be provided with a control transformer to utilize a 24 volt control circuit with fan time delay control to purge unit of excess heat after unit shut down, and an automatic high limit cut-out. Motor contacts shall be provided on three-phase units and all units larger than 5.0 KW.

F. Units shall be furnished with wall mounted or unit mounted thermostat (refer to drawings) with Summer "Fan Only" switch, off switch, 65 Deg.F. to 90 Deg.F. range and heat position switch with number of stages to match scheduled heater.

G. Provide mounting brackets for ceiling suspension or wall swivel mount suitable for the applicable installation condition or as indicated on the Drawings. Provide minimum two point threaded hanger connection, mounting sockets, on suspended units over 100 pounds in weight. Provide four point connections on units over 200 pounds in weight.

H. Each unit shall be design-certified by Underwriters Laboratories and be UL listed and meet the requirements of the NEC.

I. Supply air shall be drawn and discharged through an outward drawn venturi. Provide individual, adjustable, horizontal discharge air louvers with 30 Degrees downward stops to prevent complete shut-off of air flow.

J. Heater shall be designed for a single electrical circuit, with elements, motor and control circuits subdivided with factory fuses to conform to the National Electric Code and Underwriter's Laboratory requirements. An access panel, with wiring diagram attached, shall be provided for access to electrical control circuiting and protective devices.

K. Acceptable manufacturers:

1. Reznor.
2. Modine.
3. Emerson.
4. Q-Mark.
5. Markel.
6. BERKO.

PART 3 - EXECUTION

3.1 DELIVERY AND PROTECTION

A. Deliver all equipment to each site as indicated in Division 1.

B. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost to the Owner.

C. Protect equipment during construction. Equipment damaged during construction prior to "Substantial Completion" shall be repaired or replaced at no cost to the Owner.

3.2 INSTALLATION

A. Install and wire electric heating equipment and field installed appurtenances in full accordance with the recommendations of the unit manufacturers and as indicated on the Drawings.

B. Provide power and control wiring as specified herein and as indicated on the Drawings.

C. Follow all national and local codes related to the wiring of electrical heating devices.

D. Verify correct installation and operation of each device installed.

END OF SECTION

SECTION 26 00 00

ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Division and all Electrical sections contained hereinafter are subject to the Contract Documents of Division 1 whether attached or not, the various Divisions of the General Construction specifications and Division 23 of the Construction specifications and respective plans.

B. All drawings, material in other Divisions of these specifications, addenda, and other pertinent documents are considered to be a part of the technical requirements of this Division of the specifications insofar as they are applicable.

C. The material contained in this section shall be applicable to other sections of the specifications under this Division.

1.2 DEFINITIONS

A. The following definitions shall apply to all sections of this Division:

1. "Owner" shall mean the Owner or his designated representative.

1.3 SCOPE OF WORK

A. This Division and all electrical sections of the specifications include all labor and material to complete all electrical systems as specified or shown on the Drawings.

B. All work shown and specified shall be completely installed and connected in a workmanlike manner by mechanics properly qualified to perform the work required. All work shall be left in a satisfactory operating condition as determined by the Owner.

C. Provide all services and perform all operations required in connection with or properly incidental to the construction of complete and fully operating systems with all accessories as herein specified or shown on the Drawings.

1.4 GENERAL

A. The accompanying plans show diagrammatically the location of the various light fixtures, devices, conduits and equipment items, and methods of connecting and controlling them. It is not intended to show every connection in detail or all fittings required for a complete system. The Contractor shall carefully lay out his work at the site to conform to the conditions, to avoid obstructions and provide proper routing of raceways. Exact locations of light fixtures, devices, equipment, and connections thereto shall be determined by reference to the accompanying Plans, etc., by field measurement at the project, and in cooperation with other Contractors and Sub-Contractors, and in all cases shall be subject to the approval of the Owner. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without any additional cost to the Owner.

B. These specifications and the accompanying drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will insure complete and satisfactorily operating installations. The Contractor shall be responsible for the proper fittings of his material and apparatus into the building and shall prepare installation drawings for all critical areas illustrating the installation of his work as related to the work of all other trades. Interferences with

other trades or with the building structures shall be corrected by the Contractor before the work proceeds. Should any changes become necessary due to failure to comply with these stipulations, the Contractor shall make such necessary changes at his own expense.

C. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted on the Drawings.

D. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide those details or special construction as well as to provide material and equipment usually furnished with such systems or required to complete the installation.

E. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability and that he will install his work in a satisfactory manner which is up to the best standards of the trade, complete and in good working order. If any of the requirements of the Drawings and Specifications are impossible to perform, or if the installation when made in accordance with such requirements will not perform satisfactorily, he shall report such occurrences to the Owner promptly after discovery of the discrepancy.

F. No extra compensation will be allowed for extra work or changes caused by failure to comply with the above requirements.

1.5 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on the Drawings or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil, conditions, and local requirements. The submission of bids shall be deemed evidence of such visit.

B. All proposals shall take these existing conditions into consideration, and the lack of specific information on the Drawings shall not relieve the Contractor of any responsibility.

C. All site visits shall be coordinated and scheduled with the Owner.

1.6 CUTTING AND PATCHING

A. When cutting or patching becomes necessary to permit the installation of any work under this contract, or should it become necessary to repair any defects that may appear in patching up to the expiration of the guarantee, such cutting shall be done under the supervision of the Architect by the trade or Contractor whose work is to be disturbed. After the necessary work has been completed, damage shall be repaired by the Contractor or trade whose work has been disturbed. The cost of all such cutting and patching shall be paid by the Contractor requiring it to be done.

1. Refer to Division 1 requirements.

B. The Contractor shall do all necessary cutting and drilling of present walls, floors, ceilings, etc. for the installation of new work or for modifications to the existing work, but no structural work shall be cut unless specifically approved by the Architect. Patching and painting of services as required shall be by the General Contractor unless specified otherwise hereinafter.

C. Locations of the various existing services, walls, and equipment to be altered, removed or connected to have been taken from plans of the existing building and other substantially reliable sources and are offered as a general guide only, without guarantee as to their accuracy. This Contractor shall examine the site and shall verify to his own satisfaction the location of all existing work and shall adequately inform himself as to their relation to and effect on the work before entering into a contract. Submission of a bid shall constitute evidence that the submitting Contractor has inspected the site of the proposed work.

D. The Contractor shall examine the existing building and plans for the new work and note the sizes of the openings available and shall be responsible for any cutting, patching, and alterations required to place new equipment in the building.

E. Where walls, acoustical tile, suspended ceilings, etc., not scheduled to be re-worked or re-finished under the general contract are damaged during installation of new raceways, or other work, etc., such walls, tiles, etc., shall be replaced by the General Contractor at the expense of the Contractor.

F. All damage done to the existing equipment, services, etc., incurred in the execution of this contract shall be repaired and restored to its original conditions by the Contractor.

G. Holes through concrete shall be drilled with "Mole", or "Core-It", or equal diamond point hole saw.

1.7 DEMOLITION OF EXISTING EQUIPMENT

A. Certain types of equipment will be retained by the Owner. The Owner will provide a list of all such salvage items. Before removal of any equipment, contact the Architect, who will determine the disposition. Equipment designated to be salvaged and remain the property of the Owner shall be carefully removed to prevent damage and delivered to a location on the site as directed by the Architect. Any equipment not retained by the Owner shall become the property of the Contractor and shall be removed from the premises.

B. The Contractor shall visit the site and verify all outlets, devices, wall switches, light fixtures, etc., that are to be removed due to remodeling work and building additions.

C. The attendant raceways, hangers, wiring, foundations, etc., of those items of existing equipment to be removed and not intended for reuse, shall also be removed in their entirety. No raceways, hangers, etc., shall be abandoned in place except those raceways concealed in existing walls or buried below grade.

1.8 CODE REQUIREMENTS

A. All work shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Architect, and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies, and all authorities having jurisdiction over the work, or services thereto. In all cases where alterations to, or deviations from, the drawings and specifications are required by the authority having jurisdiction, report the same in writing to the Architect and secure his approval before proceeding. Upon completion of the work, furnish a statement from the inspecting authority stating that the installation has been accepted and approved. Provide complete utility service connections as directed, and submit, as required, all necessary drawings; secure all permits and inspections necessary in connection with the work, and pay all legal fees on account thereof. In the absence of other applicable local codes acceptable to the Architect, the National Electrical Code shall apply to this work.

1.9 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all locations of equipment, panels, and all deviations and/or changes in the work shall be recorded. All underground and overhead utilities provided under, or affected by, work of this Division shall be accurately located by dimensions. These "Record" drawings shall be delivered to the Architect in good condition upon the completion and acceptance of the work and before final payment is made.

1. Refer to Division 1 requirements.

1.10 RECORDS AND INSTRUCTIONS FOR OWNER

A. The Contractor shall accumulate, during the project's progress, the following sets, prepared in neat brochures or packet folders and turned over to the Architect for checking and subsequent delivery to the Owner:

1. All warranties and guarantees and manufacturer's directions on equipment and material covered by the Contractor.
2. Approved equipment brochures, wiring diagrams and control diagrams.
3. Copies of reviewed Shop Drawings.
4. Operating instructions for all systems. Operating instructions shall include recommended maintenance procedures.
5. Any and all other data and drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

B. All of the above data shall be submitted to the Architect for review at such time as the Contractor makes application for final payment, but in no case less than two weeks before final observation.

C. The Contractor shall also give not less than two (2) days of operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in above paragraphs shall be used as a basis for this on-the-job instruction.

1. Refer to Division 1 requirements.

1.11 SHOP DRAWINGS AND SUBMITTALS

A. The Contractor shall submit, to the Architect, shop drawings and catalog data on all equipment and materials designated on the Drawings and specified herein.

B. The submittal will be reviewed for compliance with general requirements of design and arrangement only; it is not a contract document and acknowledgement of compliance does not relieve the Contractor from responsibility for performance of the work in compliance with all provisions and requirements of the Contract Documents. Job measurements and the coordination of all the dimensions for proper fit of all parts of the work and performance of all equipment supplies to meet specification requirements are and remain specific responsibilities of the Contractor.

C. Shop Drawings shall be furnished by the Contractor for the work involved after receiving approval on the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job, and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary detailed drawings. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary, and should there be any charges in connection with this, they shall be borne by the Contractor.

D. The Shop Drawings submitted shall not consist of manufacturers' catalogues or tear sheet therefrom that contain no indication of the exact item offered. Rather, the submission on individual items shall designate the exact item offered.

E. Shop Drawings submitted without indicating markings or Contractor's stamp shall not be reviewed and will be returned to the Contractor for correction of such discrepancies.

F. The Shop Drawings are not intended to cover detailed quantitative lists of electrical specialties, and similar items, as the plans and specifications illustrate and describe those items, and it is the Contractor's responsibility to procure the proper sizes and quantities required to comply with the established requirements.

G. Any Shop Drawings prepared to illustrate how equipment can be fitted into available spaces will be examined under the assumption that the Contractor has verified all the conditions, and obtained any approval thereon shall not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those Drawings.

H. Various material submissions of such as raceways, switches, panelboards, and related items shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets.

I. Each Contractor shall process his submitted data to insure that it conforms to the requirements of the plans and specifications and that there are no omissions, errors or duplications.

J. Shop Drawings shall be accompanied by certification from this Contractor that Shop Drawings have been checked by him for compliance with Contract Drawings.

K. Samples of various products or mock-ups of particular details or systems may be required by various sections of this Specification.

L. Refer to Division 1 requirements.

1.12 PENETRATIONS THROUGH FIRE-RATED ASSEMBLIES

A. Seal voids around ducts and pipes penetrating fire-rated assemblies and partitions using fire-stopping materials and methods in accordance with provisions in Division 1.

1.13 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. All equipment furnished under other Divisions of the specification requiring service connections shall be connected by this Contractor. Materials and labor required for the connection of this equipment shall be furnished under Division 26. The respective supplier shall furnish proper roughing-in diagrams for the installation of these items. All items shall be roughed-in and connected in strict accordance therewith. All equipment requiring connection may not be specified herein, but may be included in other Division documents. This Contractor shall ascertain for himself all equipment so specified is included as part of his work.

B. Refer to Section 26 05 23.

1.14 DRAWINGS

A. The drawings show diagrammatically the locations of the various conduits, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building and in cooperation with other trades and, in all cases, shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in the location of any of this work without additional cost to the Owner.

B. Should any changes be deemed necessary in items shown on the contract drawings, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Architect for approval.

C. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before bids are submitted; otherwise, the Contractor shall be responsible for the cost of any and all changes and additions that may be necessary to accommodate his particular apparatus.

D. Lay out all work maintaining all lines, grades, and dimensions according to these drawings with due consideration for other trades and verify all dimensions at the site prior to any fabrication or installation; should any conflict develop or installation be impractical, the Architect shall be notified before any

installation or fabrication and the existing conditions shall be investigated and proper changes effected without any additional cost.

E. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of material and/or work. The Architect does not assume any responsibility, either direct or implied, for omissions or duplications by the Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.

1.15 COOPERATION

A. All work under these specifications shall be accomplished in conjunction with other trades on this project in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.

B. Maintaining contact and being familiar with the progress of the general construction and the timely installation of sleeves and inserts, etc., before concrete is placed shall be the responsibility of this trade as will the installation of the required systems in their several stages, at the proper time to expedite this contract and avoid unnecessary delays in the progress of other contracts.

C. Should any question arise between trades as to the placing of lines, ducts, conduits, or equipment, or should it appear desirable to remove any general construction which would affect the appearance or strength of the structure, reference shall be made to the Architect for instructions.

1.16 MATERIALS AND EQUIPMENT

A. All materials purchased for this Project shall be new.

B. Where specified product is not manufactured, manufacturer's current product meeting specification shall be substituted, subject to written approval of Engineer.

C. Space allocations in electrical spaces are based on equipment scheduled in each case. Should the Contractor offer equipment of another make, he shall verify that such equipment will fit in the spaces allowed.

D. Manufacturers' names are listed herein to establish a standard. The products of other manufacturers will be acceptable; if, in the opinion of the Architect, the substitute material is of a quality as good or better than the material specified, and will serve with equal efficiency and dependability, the purpose for which the items specified were intended.

E. It is fully the Contractor's responsibility to assemble and submit sufficient technical information to fully illustrate that the material or equipment proposed for substitution is equal or superior as the Architect or his Engineer is under no obligation to perform the service for the Contractor. The proposal shall be accompanied by manufacturers' engineering data, specification sheet, and a sample, if practical or if requested. In no event shall a proposal for substitution be cause for delay of work.

F. Should a substitution be accepted under the above provisions, and should the substitution prove defective or otherwise unsatisfactory for the intended service, within the warranty period, the Contractor shall replace the substitution with the equipment or material specified, and on which the specifications required him to base his proposal.

1.17 STORAGE AND PROTECTION OF MATERIALS

A. The Contractor shall provide his own storage space for protection and storage of his materials and assume complete responsibility for all losses due to any cause whatsoever. All storage shall be within the property lines of the building site, or as directed by the Owner's representative. In no case shall storage interfere with traffic conditions in any public or project thoroughfare.

B. All work and material shall be protected at all times. This Contractor shall make good any damage caused, either directly or indirectly, by his workmen. He shall be responsible for safe handling of all electrical equipment and shall replace, without charge, all items damaged prior to acceptance by the Owner.

1.18 SCHEDULE OF WORK

A. The work under the various sections must be expedited and close coordination will be required in execution of the work. The various Contractors shall perform their work at such times as directed so as to insure meeting scheduled completion dates, and to avoid delaying any other Contractor. The Architect will set up completion dates, schedule the times of work in the various areas involved, etc. This Contractor shall cooperate in establishing these times and locations and shall process his work so as to insure the proper execution of it.

1.19 CONTINUATION OF SERVICES

A. The Contractor shall realize that the existing building must continue in operation during the construction period, except as the Architect and the Owner may direct otherwise.

B. Under no conditions shall any work be done in the present building that would interfere with its natural use during the normal hours of occupancy, unless special permission is granted by the Owner. This is particularly applicable where new connections are to be made to present services or items of equipment in the building or where present equipment items in the building are to be relocated or modified in any way.

C. Existing utility systems shall continue to function with a minimum of interruptions in service. This Contractor shall install any temporary lines, connections, etc., required to place and maintain the electrical systems in operation unless otherwise directed by the Architect.

D. Arrange for and provide temporary electric and telephone services to the building where new construction conflicts with existing utility locations.

1.20 COMMISSIONING OF EQUIPMENT AND SYSTEMS

A. The Contractor shall provide qualified personnel, as requested by the Owner and Architect, to assist in all on-site testing and commissioning of all equipment.

1.21 CLEANING UP

A. The Contractor shall be responsible for cleaning up his work as specified in the General Requirements of these Specifications.

1.22 FINAL OBSERVATION

A. Schedule: Upon completion of the Contract, there shall be a final observation of the completed installation. Prior to this observation, all work under this Division shall have been completed, tested, and balanced and adjusted in final operating condition and the test report shall have been submitted to and approved by the Owner.

B. Qualified personnel representing the Contractor must be present during final observation to demonstrate the systems and prove the performance of the equipment.

1.23 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications.

B. Furnish, at the completion of the job, a final Inspection Certificate from the local inspecting authority.

1.24 GUARANTEE

A. The guarantee provision of this specification requires prompt replacement of all defective workmanship and materials occurring within one year of final job acceptance. This includes all work required to remove and replace the defective item and to make all necessary adjustments to restore the entire installation to its original specified operating condition and finish at the time of acceptance. The Contractor shall also guarantee that the performance of all equipment furnished and/or installed under this Division of the specifications shall be at least equal to the performance as called for in the specifications and as stated in the equipment submittals. Should there be indication that the equipment and installation is not producing the intended conditions, the Contractor shall make further tests as the Engineer may direct to demonstrate that the equipment installed meets the specifications. If there is indication that the equipment does not meet the specifications, the Contractor shall, at his expense, institute a program to demonstrate the adequacy of the installation. This program shall include all necessary testing and testing equipment. Should the Contractor not have the equipment or technical skill to perform the tests, it shall be his responsibility to provide recognized experts to perform the tests and shall provide certified laboratory tests, certified factory reports and work sheets, or other certified data to support results of any tests required.

B. Refer to Division 1 requirements.

PART 2 - PRODUCTS

NOT USED

PART 3 - INSTALLATION

3.1 DEVICE MOUNTING REQUIREMENTS

A. Mounting heights listed in Drawings shall be defined as measured from the centerline of the device or outlet box to finished floor elevation. Unless specifically noted otherwise on the Drawings. Device heights shall be in accordance with the Texas Accessibility Standards or the Americans with Disabilities Act.

B. Where devices are grouped together, they shall be mounted at the same height.

C. Coordinate all mounting dimensions with Owner's requirements and coordinate with architectural elevations and details.

END OF SECTION

SECTION 26 05 01

ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1- General Requirements and related documents.

B. All sections of this Specification.

1.2 DESCRIPTION

A. Contractor shall remove several items of materials and equipment under this section of the specifications. Equipment and materials to be removed shall be as indicated and noted on the Drawings and as required to facilitate the new installations.

B. Provide labor, materials, equipment, tools and services as required to complete the demolition work indicated.

C. Refer to Division 1 for "Schedule of Work".

1.3 DISRUPTION OF EXISTING FUNCTIONS

A. Under no conditions shall any work be done in the present building that would interfere with its natural or intended use unless special permission is granted by the Owner.

B. Disruptions: Maintain existing lighting, power, telephone, and other systems, and maintain existing functions in service, except for scheduled disruptions as allowed in Division 01, "General Conditions".

C. Provide all temporary connections as necessary to facilitate the phasing of construction.

1.4 SALVAGE, DEMOLITION, AND RELOCATION

A. It shall be the responsibility of the Contractor to remove and store those items of existing equipment as indicated on the Drawings to be removed. All items of equipment or fixtures removed shall be protected from damage insofar as is practical.

B. These items shall be stored on site for a minimum of two (2) weeks unless indicated otherwise by the Owner's representative to allow for inspection by the Owner. Deliver, all items tagged to be retained by the Owner to a designated storage location on site or to the Owner's designated Service Center or Warehouse. All items not retained by the Owner shall be removed from the site by the Contractor at no additional cost to the Owner.

C. The attendant conduit, hangers, foundations, etc., of those items of existing equipment to be removed, shall also be removed in their entirety. No hangers, etc., shall be abandoned in place.

D. Relocations:

1. Repair and restore to good functional condition materials and items scheduled for relocation and/or reuse and which are damaged during dismantling or reassembly operations.
2. New materials and items of like design and quality may be substituted for materials and items indicated to be relocated, in lieu of relocation, upon approval of shop drawings, product data and samples.
3. Remove carefully, in reverse to original assembly or placement, items which are to be relocated.
4. Protect items until relocation is complete.

5. Clean and repair and provide new materials, fittings, and appurtenances required to complete the relocation and to restore to good operative order.
6. Perform the relocation work in accordance with pertinent sections of the specifications, utilizing skilled workers.
7. Refer to Drawings for specific requirements of temporary services and relocated equipment and fixtures.
8. Coordinate with the General Contractor repairs required to bring finishes back to their original conditions after demolition and or installation of new equipment.

1.5 CLEAN UP

A. Remove all debris, rubbish, and materials resulting from cutting, demolition, or patching operations from the work area on a daily basis.

B. Transport materials and legally dispose of off site.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide materials and equipment for patching and extending work as specified in individual sections or as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Conditions: Demolition Drawings are based on non-invasive field observations and existing record documents. Report discrepancies in location, dimensions or quantity to Owner and Architect prior to disturbing existing installation.

B. Abandoned Wiring: Verify that abandoned wiring and equipment serve only facilities scheduled for demolition.

C. Existing Conditions: Commencing demolition means Contractor accepts existing conditions.

3.2 PREPARATION

A. Demolition: Disconnect electrical systems in walls, floors, ceilings and equipment scheduled for removal.

B. Project Coordination: Coordinate utility service outages with utility companies and schedule work with Facility management and Owner.

C. Temporary Wiring: Provide temporary wiring and connections as necessary to maintain existing systems in service during construction.

D. Schedule installation of temporary wiring and connections to eliminate hazard to installing personnel.

1. When work must be performed on energized circuits or equipment, use qualified personnel experienced in such operations.
2. Submit "hot work" policy information to Architect for review prior to performing work on any energized circuits.

E. Electrical Service: Maintain existing system in operation until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission, in writing, from Owner prior to partially or completely disabling system. Minimize outage duration. Make temporary connections as necessary to maintain service to areas unaffected by the scope of Work.

F. Telephone Service: Maintain existing system in operation until new system is complete and has been accepted. Disable system only to make switchovers and connections. Obtain permission, in writing, from Owner, and notify the utility company, prior to partially or completely disabling system. Minimize outage duration. Make temporary connections as necessary to maintain service to areas unaffected by the scope of Work.

G. Special Systems: Maintain existing systems in operation until new systems are complete and have been accepted. Disable systems only to make switchovers and connections. Obtain permission, in writing, from Owner prior to partially or completely disabling systems. Minimize outage duration. Make temporary connections as necessary to maintain service to areas unaffected by the scope of Work.

1. The following systems will be affected by the scope of Work:

a. Fire Alarm System
b. Public Address System
c. Security System
d. Data System

3.3 DEMOLITION AND EXTENSION OF EXISTING WORK

A. General: Demolish and extend existing work as indicated or described in the Drawings and Specifications.

1. Lighting fixtures and electrical distribution equipment shall be salvaged for possible re-installation as directed by the Owner and Architect.

B. Wiring: Remove abandoned wiring and cables to source of supply or termination.

C. Raceways:

1. Remove exposed abandoned conduits and raceways, including abandoned conduits and raceways above accessible ceilings.
2. Conduits and raceways concealed in existing construction to remain shall be abandoned in place. Cut conduits and raceways such that finished surfaces can be patched smooth.

D. Wiring Devices: Remove abandoned wiring devices. Provide blank device plate for outlet box not being removed.

E. Electrical Distribution Equipment: Disconnect and remove abandoned panelboards and electrical distribution equipment.

F. Lighting Fixtures: Disconnect and remove abandoned lighting fixtures, including brackets stems, hangers and other accessories not indicated to be re-used.

G. Existing Installations to Remain: Maintain access to existing electrical installations which remain active.

H. Modify installation or provide access panel as required.

I. Extension of existing circuits: Extend existing installations as required to maintain service to items to remain using materials and methods, as specified that are compatible with original installation.

J. Adjacent Construction: Repair adjacent construction and finishes damaged during demolition and extension work.

K. Dispose of hazardous materials, such as fluorescent and H.I.D. lamps and PCB's in lamp ballasts, in accordance with all Local, State and Federal ordinances and regulations.

3.4 SALVAGED MATERIALS

A. Salvage existing materials for re-installation as directed by Owner. Coordinate locations for storage of salvaged materials with Owner.

3.5 CLEANING AND REPAIR

A. Existing Materials: Clean and repair existing materials and equipment which remain or are to be re-used.

B. Existing Panel boards: Clean exposed surfaces and check tightness of all electrical connections. Replace damaged circuit breakers with units of compatible construction and provide closure plates for vacant positions.

C. Existing Lighting Fixtures: Where existing lighting fixtures are indicated to remain, clean reflector and lens and replace lamps.

1. Use mild detergent to clean all interior and exterior surfaces; rinse with clean water and wipe dry; allow to dry thoroughly prior to re-installation.
2. Replace lamps and broken electrical components. Replace cracked or broken lenses and louvers with new identical materials.
3. Ballasts: Replace ballasts in all fluorescent lighting fixtures to remain or to be re-used with new ballasts as specified.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Provide systems of wires and cables for electric power, signaling and control.

B. Related work specified in other sections

1. 26 00 00 - Electrical
2. 26 05 20 - Cable Connections
3. 26 05 23 - Control Voltage Electrical Power Cables
4. 26 05 32 - Raceways
5. 26 05 33 - Boxes for Electrical Systems

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 REFERENCED STANDARDS

A. ICEA 5-61-402 Thermoplastic Insulated Wire and Cable

B. ICEA 5-66-524 Cross Linked Thermosetting Polyethylene Insulated Wires and Cables

C. ICEA 5-68-516 Ethylene Propylene Rubber Insulated Wire and Cable

D. ICEA 5-19-81 Rubber Insulated Wire and Cable

E. ANSI 1581 Standard of Electrical Wires, Cables, and Flexible Cords.

F. UL 83 Thermoplastic Insulated Wires and Cables

G. UL 1569 Metal Clad Cables

H. ASTM B3 Standard Specification for Soft or annealed Copper Wire

I. ASTM B8 Standard Specification for Concentric Lay Standard Copper Conductors

1.5 SUBMITTALS

A. Where products are of a manufacturer other than listed as acceptable manufacturers, submit manufacturer’s product literature completely describing conductors and cable assembles and evidence of U.L. Listing.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver conductors and cable assemblies to the project in the manufacturer's standard reels or boxes marked with conductor material, insulation type, conductor size and U.L. Label.

B. Store conductors and cable assemblies in a clean, dry location to prevent damage from moisture, dust, personnel and equipment.

C. Handle conductors and cables in a manner to prevent damage to conductor, insulation, jackets, and identifying markings.

1.7 MANUFACTURERS

A. The material shall be the product of a manufacturer with a minimum of ten years experience in the manufacture of similar material.

B. Acceptable Manufacturers:

1. AFC Cable Systems.
2. Cerro Wire, Inc.
3. General Cable
4. Southwire Company
5. Okonite Company

1.8 WARRANTY

A. The material shall be warranted to be free from defect and in proper working order for one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Copper Conductors

1. Conductors shall be copper unless specifically noted otherwise on the Drawings.
2. Copper conductors shall be soft drawn annealed copper, minimum conductivity 98% of pure copper per ASTM ASTM-B3.
3. Sizes No. 10 AWG and smaller shall be solid conductor, single strand.
4. Sizes No. 8 AWG and larger shall be concentric lay Class B stranding.
5. Shall conform to the Conductor Properties proscribed in the NEC.

B. Insulation

1. Type THW: 600 volt moisture and heat resistant thermoplastic rated 75 Deg.C. in wet or dry loactions.
2. Type THW-2: 600 volt moisture and heat resistant thermoplastic rated 90 Deg.C. in wet or dry location.
3. Type THWN: 600 volt moisture and heat resistant thermoplastic rated 75 Deg.C. in wet or dry.
4. Type THWN-2: 600 volt moisture and heat resistant thermoplastic rated 90 Deg.C. in wet or dry locations.
5. Type XHHW: 600 volt moisture resistant cross linked polyethylene rated 75 Deg.C. in wet or dry locations.
6. Type XHHW-2: 600 volt moisture resistant cross linked polyethylene rated 90 Deg.C. in wet or dry locations.

C. Cable Assemblies:

1. Type MC Branch Circuit Cable: 600 volt, Type THHN/THWN conductors size 12 AWG through 10 AWG, including a green insulated grounding conductor, with steel interlocked armor applied over the assembly.

PART 3 - EXECUTION

3.1 USES PERMITTED

A. Unless specifically noted on the drawings, permitted by the NEC and local codes and ordinances, wiring shall be Types THW-2, THWN-2 or XHHW-2 installed in metal raceways as specified in 26 05 32, Raceways.

B. Where specifically noted on the drawings, permitted by the NEC and local ordinances, Type UF cable assemblies shall be permitted for underground branch circuit wiring.

C. Where specifically noted on the drawings, permitted by the NEC and local codes and ordinances, type NM cable assemblies shall be permitted for above ground branch circuit wiring.

D. For final connections from junction boxes mounted on the building structure to recessed lighting fixtures. Type MC cable assemblies shall be permitted, with the cable assembly length not to exceed six feet and with supports as required by the NEC. Fixture-to-fixture chain wiring is not permitted.

E. Where specifically noted on the drawings, permitted by the NEC and local ordinances, Type MC Branch Circuit cable shall be permitted for branch circuit wiring and where concealed in stud spaces of dry wall partitions. NEC requirements for supporting from the structure independent of ceiling systems or ceiling support wires will be strictly mandated. All home runs from the first box to the panelboard shall be in EMT.

F. Where specifically noted on the drawings, permitted by the NEC, Type MC Feeder Cable shall be permitted in exposed unfinished spaces and above ceilings. NEC requirements for supporting from the building structure will be strictly mandated.

3.2 COLOR CODING

A. Where available, insulation shall be color coded by factory pigmentation for each phase and each voltage system employed on the project.

B. 120/208 and 120/240 volt systems:

1. Phase A - Black
2. Phase B - Red
3. Phase C - Blue
4. Neutral - White
5. Ground - Green

C. 277/480 volt systems:

1. Phase A - Brown
2. Phase B - Orange
3. Phase C - Yellow
4. Neutral - Gray
5. Ground - Green

D. Switch legs, travelers and special systems shall be continuous color scheme throughout the project as selected by the Contractor.

E. Where factory pigmentation is not available, code conductors with 1-1/2" colored tape band at each terminal and at each pull or junction box.

3.3 GROUNDING CONDUCTORS

A. All branch circuits and feeders shall include an insulated equipment grounding conductor. Raceway systems shall not be used as the sole equipment grounding path without specific approval.

3.4 MULTIWIRE BRANCH CIRCUITS

A. Multiwire branch circuits shall not be permitted unless required by the device served, such as for connection to modular furniture systems or track lighting systems.

B. Where multiwire branch circuits are required, branch circuit breakers shall be two or three pole with common trip and one handle.

3.5 MINIMUM SIZE

A. Conductors shall be of the minimum size shown on the drawings, lighting and power branch circuit wiring shall be minimum No.12 AWG.

B. Feeder circuit wiring shall be sized to limit the effect of voltage drop, based on the actual installed conductor length to limit voltage drop to 2% of nominal system voltage.

C. Branch circuit wiring shall be size to limit the effect of voltage drop, based on the actual installed conductor length, to limit voltage drop to 3% or less of nominal system voltage.

D. Circuits shall be grouped in raceways and grouped together when passing through enclosures to have phases and neutral grouped together to minimize circuit reactance.

3.6 INSTALLATION

A. Examine the system in which the conductors are to be installed for defects in equipment and installation which may cause damage to the conductors, insulation, or jackets.

B. Pull a swab or mandrel through conduit systems immediately before pulling conductors to insure a full bore, clean raceway system.

C. Do not exceed the conductor manufacturer’s maximum pulling force or minimum bending radius.

D. Use pulling lubricant compound where necessary and recommended by the manufacturer.

E. Conductors or cables which have insulation or jackets damaged in the pulling process shall be removed and replace with new material.

3.7 FIELD QUALITY CONTROL

A. Test all wiring insulation with a megohm meter prior to energization:

1. Phase to ground
2. Phase to phase
3. Phase to neutral
4. Neutral to ground

B. Perform test in accordance with manufacturer’s recommendation and to meet manufacturer’s published minimum insulation values.

C. Correct all defects revealed by such tests including replacing material with new as required.

END OF SECTION

SECTION 26 05 20

CABLE CONNECTIONS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1- General Requirements and related documents.

B. All sections of this Specification.

1.2 DESCRIPTION

A. Work Included: Provide wire connections and devices to be readily identifiable, mechanically and electrically secure wiring system.

B. Related work specified in other sections:

1. 26 05 19 Low Voltage Electrical Power Conductors and Cables

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Product Data: If materials are by manufacturers other than those specified, submit product data giving complete description for sizes employed, material types, and electrical ratings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Connections shall be made in atmospheres that are free from dirt, moisture, and elements which may be damaging.

1.6 MANUFACTURERS

A. The materials shall be the product of a manufacturer with a minimum ten years experience in the manufacture of similar materials.

B. Acceptable manufacturers are listed with the products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Spring Connectors: Ideal "Wingnut" 3M-Scotch, Buchanan, and Thomas and Betts.

B. Terminal Connectors: O-Z/Gedney, Burndy, and Thomas and Betts.

C. Splice Connectors: O-Z/Gedney or Burndy with insulating cover.

D. "T" and Parallel Connectors: O-Z/Gedney or Burndy with insulating cover.

E. Vinyl Plastic Tape: 3M-Scotch #33 or #88, Plymouth and Okonite.

F. Rubber Tape: Okonite, 3M-Scotch and Plymouth.

G. Colored Tape: 3M-Scotch, Plymouth.

H. Wire Ties: Thomas and Betts "Ty-Rap", Ideal and Panduit.

I. Tie Mounts, Plates, Anchors: Thomas and Betts, Ideal, and Panduit.

J. Wire Tags: Self-laminating, cloth, wrap-on type by Thomas and Betts, Ideal, and Brady.

K. Terminal Strips: Nylon; 600 volt; modular plug-on construction; tubular compression slip-in terminals properly sized; complete with mounting track, end clips, and anchors by Allen-Bradley, Square D, and Buchanan.

L. Cable and Cord Fittings: Crouse-Hinds with wire mesh grip or Appleton.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine wires to be joined, tapped, spliced, terminated, and their connecting devices for defects which may affect the mechanical and electrical integrity of the connection.

B. Do not proceed until defects are corrected.

3.2 PREPARATION

A. Remove proper amount of insulation necessary for connection, clean conductors.

3.3 INSTALLATION

A. No. 10 Wire and Smaller: Connect with spring connectors, terminate at terminal strips.

B. No. 8 Wire and Larger: Connect and terminate with above specified tape half-lapped to produce a dielectric value equal to wire insulation.

C. Train, hold, clamp, and tag wiring in cabinets, pull boxes, panels, and junction boxes with above specified devices.

D. Splices in feeders and mains may only be made where designated on the drawings and where prior approval is obtained from the Architect.

E. Install terminal strips in enclosures without means for termination of wiring.

F. Install cable and cord grips on all cables and cords, entering enclosures. Use wire mesh grips where necessary for strain relief.

3.4 FIELD QUALITY CONTROL

A. Test: Connections shall be resistance tested with megohm meter as specified for wire.

3.5 ADJUSTMENTS

A. Assure that wire connections made by others in equipment furnished by others are mechanically and electrically sound prior to energization.

END OF SECTION

SECTION 26 05 23

CONTROL - VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Work Included: Provide power wiring, raceways, and connections for items of equipment and control systems.

B. All wiring for every system shall be installed in metal conduit. Refer to Section 26 05 32 Raceways for conduit types and materials for specific locations and applications.

C. Related work specified in other sections:

1. 23 09 00 Instrumentation and Controls for HVAC
2. 26 00 00 Electrical
3. 26 05 19 Low Voltage Electrical Power Conductors and Cables
4. 26 05 32 Raceways
5. 26 09 26 Lighting Control Systems
6. 28 31 00 Fire Alarm System

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 WARRANTY

A. The material shall be warranted to be free from defect and in proper working order for one year following the date of final acceptance.

1.5 COORDINATION

A. For equipment furnished under other Divisions, obtain equipment supply and wiring requirements from the Contractor supplying the equipment.

B. For equipment furnished under Division 23, obtain complete temperature control system drawings, and power supply and interlock wiring requirements from the Contractor furnishing the systems.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to related work specified in other sections for material requirements.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Work Included: The Electrical Contractor shall provide:

1. Branch circuit and motor feeder circuit conductors, raceway, connections, and overcurrent protection for each motor or item of equipment furnished by the Owner or other Contractors.
2. Motor Control Centers, where indicated on the drawings.
3. Installation of motor controllers furnished by the Owner or other Contractors, along with branch circuit and motor feeder circuit conductors, raceway, and connections in accordance with the manufacturer's approved wiring diagrams.
4. Disconnect switches and combination disconnect switches and motor controllers, where indicated on the drawings or required by codes, except as provided as an integral part of manufactured equipment.
5. Power supply conductors, raceway, connections, and overcurrent protection for input power to HVAC Temperature Controls, HVAC Automation, and HVAC Energy Management Systems in accordance with approved rough-in and connection diagrams furnished by the system suppliers.
6. The above represents an outline of the work for the purpose of describing one division of the work which is acceptable to insure that all work is contained within the General Contract. Nothing herein shall be construed to confine the General Contractor from assigning the work to any member or group of contractors deemed best suited to executing the work to effect the contract. Refer to specific bidding instructions of the General Contractor for the actual division of the work. The General Contractor is fully responsible for the installation of complete, operating systems in accordance with the functional intent of the specifications.

B. Work Not Included: The Mechanical Contractor shall provide:

1. Motors and equipment, erected in place and ready for final connection of power supply wiring, along with manufacturer's approved wiring diagrams.
2. Motor controllers, in suitable enclosures and of the type and size in accordance with the manufacturer's recommendations and NEMA requirements, along with properly sized overload elements and approved wiring diagrams.
3. Disconnecting switches or devices which are normally provided as a part of manufactured equipment.
4. Rough-in and connection diagrams for input power supply and connections for the HVAC Temperature Control, HVAC Automation, and HVAC Energy Management Systems.
5. Conductors, raceways, devices, and connections for low voltage control, line voltage control, and signaling systems for the HVAC Temperature Control, HVAC Automation, and HVAC Energy Management Systems in accordance with the provisions of Division 26, and approved systems shop drawings to provide complete operating systems in accordance with the functional requirements of the specifications.
6. The above represents an outline of the work for the purpose of describing one division of the work which is acceptable to insure that all work is contained within the General Contract. Nothing herein shall be construed to confine the General Contractor from assigning the work to any member or group of contractors deemed best suited to executing the work to effect the contract. Refer the specific bidding instructions of the General Contractor for the actual division of work. The General Contractor is fully responsible for the installation of complete, operating systems in accordance with the functional intent of the specifications.

C. Completely connect all electrical consuming items of mechanical equipment, kitchen equipment, shop equipment, etc., provided by the Owner or other trades. Outlets of various types have been indicated at equipment locations, but no indications or exact location or scope of work is indicated on the accompanying drawings.

D. Refer to details and information furnished by the Owner and various equipment suppliers for equipment wiring requirements and to the Plumbing and Heating, Ventilating and Air Conditioning Specifications for the scope of the connections to equipment provided under those sections, and determine from the various trades by actual measurements at the site, and by direction from the Owner and the Architect the exact locations of all items. Roughing-in drawings, wiring diagrams, etc., required for the proper installation of the electrical work will be furnished by applicable trades furnishing equipment. Request the drawings and

information required in writing to the equipment supplier in ample time to permit preparation of the drawings and to permit proper installation of all wiring. Obtain from those furnishing equipment the size and type of service required for each motor or piece of electrical equipment and verify that the service to be installed is compatible.

3.2 INSTALLATION

A. All conduits shall terminate in conduit boxes on motors where possible. When motors are direct-connected, the conduit may continue rigid into the box, but when motors drive through belts and have sliding bases, a piece of flexible liquid tight conduit not less than 12 inches long shall be connected between the rigid conduit and the motor terminal. Where motors are not provided with conduit boxes, terminate the conduit in a condulet at the motor.

B. Where disconnecting switches are not provided integral with the control equipment for motors, provide and install a disconnect switch in the circuit to each motor where indicated and required by code. Switches shall be installed as close as possible to the motor or controls they serve and they shall be within sight of the motor or control circuit.

C. Be responsible for installing all conductors and protective devices serving equipment motors furnished by others in strict conformance with all applicable codes, regardless of any discrepancy in plans and/or mechanical equipment sizes variations, unless covered by directives issued by the Architect.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Provide a grounding electrode for the facility and a ground electrode conductor system to connect to the electric service main equipment.

B. Provide supplementary grounding electrodes as specified herein.

1. Provide connections from the grounding electrode system to:
2. The electric power system grounded circuit conductor (neutral).
3. The electric power system non-current carrying enclosures and equipment ground conductors (equipment ground).

C. Provide connections from the grounding electrode system to auxiliary ground conductors for data and voice communication systems (isolated ground).

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 REFERENCED STANDARDS

A. National Electrical Code, NFPA 70.

B. EIA/TIA Standard 607

C. IEEE - Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

D. IEEE Standard 81 - Guide for Measuring Earth Resistivity.

1.5 SUBMITTALS

A. Where products are of a manufacturer other than listed as acceptable manufacturers, submit manufacturer’s product literature completely describing conductors and cable assembles and evidence of U.L. Listing.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver conductors and cable assemblies to the project in the manufacturer’s standard reels or boxes marked with conductor material, insulation type, conductor size and U.L. Label.

B. Store conductors and cable assemblies in a clean, dry location to prevent damage from moisture, dust, personnel and equipment.

C. Handle conductors and cables in a manner to prevent damage to conductor, insulation, jackets, and identifying markings.

1.7 MANUFACTURERS

A. The materials shall be the products of a manufacturer with a minimum of ten years experience in the manufacture of similar material.

B. Acceptable manufacturers shall be as listed with the material descriptions.

1.8 WARRANTY

A. The material shall be warranted to be free from defect and in proper working order for a period of one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Conductors buried in contact with the earth shall be bare copper, solid for sizes up to No. 6 AWG, concentric lay strand for sizes No. 8 AWG and larger.

B. Conductors for installation below raised access floor systems shall be bare copper, solid for sizes up to No. 6 AWG, concentric lay strand for sizes No. 8 AWG and larger.

C. All other grounding conductors shall be copper conductor, Type THWN 600 volt 90 Deg.C. thermoplastic insulation, green color where available.

2.2 CONNECTIONS

A. All connections made below grade, in inaccessible locations, and all connections and splices in the grounding electrode conductor system shall be made by exothermic weld process equal to Cadweld. Provide polyethylene inspection well covers and lids equal to Erico #T416B.

B. All other connections shall be hydraulically crimped irreversible connectors equal to Thomas and Betts 54000 Series.

C. Connections to raised access floor system pedestals shall be Thomas and Betts 38268 malleable iron mechanical clamp.

D. Connections to cable trays shall be Thomas and Betts 10105 malleable iron mechanical clamp.

E. Connections to domestic cold water piping shall be Thomas and Betts GUV Series copper alloy U-bolt and mechanical clamp.

F. Connections to building structural steel shall be exothermic weld equal to Cadweld.

G. Connections which require flexibility for movement, expansion, or vibration shall be made with flexible flat conductor, multiple strands of 30 gauge copper conductors or equivalent circular mil area to the primary ground conductor. Protect ends with copper bolt hole end pieces.

2.3 CONDUITS

A. Provide malleable iron conduit grounding bushings where:

1. Metallic raceways terminate at metal housings without mechanical and electrical connection to housing.
2. At each end of metallic conductors for grounding conductors where conduits are electrically non-continuous.
3. At the ends of service entrance conduit.

PART 3 - EXECUTION

3.1 EQUIPMENT GROUNDING CONDUCTORS

A. Bond the non-current carrying parts of the electric power system to the grounding electrode conductor at the service disconnecting means. From this point forward, all non-current carrying parts of the electric power system shall be electrically connected and continuous by means of:

1. Electrically continuous equipment enclosures, metallic boxes and metallic raceways connected with U.L. Listed connectors and couplings.
2. Equipment grounding conductors supplementary to metallic raceway systems where shown on the Drawings.
3. Equipment grounding conductors in non-metallic raceway systems and in flexible metal conduit systems.
4. Where permitted under other sections of the Specification, the insulated grounding conductor provided in Type MC cable will be considered an acceptable equipment grounding conductor.
5. Uninsulated grounding strips and spiral wrap provided in Type AC cable is not an acceptable grounding conductor.

3.2 TESTING

A. Grounding Electrode:

1. The earth resistance of the main ground electrode shall be not more than 5 ohms.
2. Perform a measurement of ground resistance by one of the means described in IEEE Standard 81, Guide for Measuring Earth Resistivity.
3. Provide written certification of the ground resistance measurements upon request.

B. Grounding Continuity:

1. Provide continuity tests and checks of equipment grounding and isolated grounding conductor systems to insure electrical continuity.
2. Provide written certification of continuity checks upon requests.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1- General Requirements and related documents.

B. All sections of this Specification.

1.2 DESCRIPTION

A. Work Included: Provide miscellaneous materials for the supporting of electrical material and equipment.

B. Related work specified in other sections:

1. 26 00 00 - Electrical
2. 26 05 32 - Raceways
3. 26 27 16 - Electrical Cabinets and Enclosures
4. 26 05 33 - Boxes for Electrical Systems

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 SUBMITTALS

A. Product Data: If materials are by manufacturers other than specified, submit product data giving complete description.

1.5 MANUFACTURERS

A. Listed with Materials.

B. Acceptable Manufaturers

1. Kindorf
2. Unistrut
3. Caddy

PART 2 - PRODUCTS

2.1 MATERIALS

A. Continuous Slotted Channel: #12 gauge steel, electrogalvanized, with zinc chromate, bases and dimensions as required for application.

B. Hanger Rods: Continuous thread, electrogalvanized, with zinc chromate, sizes as required for loads imposed.

C. Hex Head Cap Screws and Nuts: No. H-113 and No. H-114, respectively.

D. One-Hole Pipe Straps: Series HS-100, galvanized steel

E. Single Bolt Channel Pipe Straps: Steel, with machine screws and nut, Series C-105 and Series C-106.

F. Lay-In Pipe Hanger: Series C-149.

G. Conduit and Pipe Hanger: Series 6H.

H. Beam Clamps: Series 500, RC, EC, and PC for applications.

I. Concrete Inserts, Spot: Series D-256 or No. D-255.

J. Concrete Inserts, Channel: Series D-980 or Series D-986.

K. Riser Clamps: Series C-210.

L. Cable Supports: O-Z/Gedney Type S.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Carefully lay out and provide concrete inserts.

B. Securely fasten and support conduits and raceways to the building structure.

C. Suspend horizontal runs of conduit and raceways from the floor and roof construction by rod hangers spaced 10 feet on less on centers for sizes 2-1/2 inches and greater and 9 feet or less on centers for sizes 2 inch and smaller.

D. Fasten single runs of conduit to the structure with one-hole pipe straps and beam clamps or hang on rod hangers.

E. Support multiple runs of conduit and raceways from continuous channel inserts or from trapeze hangers constructed of rod hangers and channels.

F. Fasten single conduits to rod hangers with adjustable lay-in pipe hangers or for 2 inches and smaller conduits with Series 6H pipe hangers.

G. Fasten conduits to channels with pipe channel straps.

H. Support conduits and raceways within 3 feet of each end of each bend, of each termination, and at other intervals to maintain horizontal and vertical alignment without sag and deformation.

I. Do not use cable, strap, and wire hangers as fasteners.

J. Provide riser clamps for conduits at floor lines. Provide wire and cable supports in pull boxes for risers in accordance with NEC Section 300-19 and Table 300-19 (a).

K. Install supports to permit equally distributed expansion and contraction of conduits and raceways with expansion joints. Use guides or saddles and U-bolts and anchors designed for equal effectiveness for both longitudinal and transverse thrusts.

L. Do not support conduits and raceways for equipment connections.

M. Provide special supports with vibration dampers to minimize transmission of vibrations and noises.

N. Provide trapeze hangers for conduits and raceways where routing interferes with ducts

O. Provide hangers, racks, cable cleats and supports for wires and cables in cable chambers and other locations to make a neat and substantial installation.

P. Provide angle iron and channel supports to the floor and structure for panelboards, cabinets, pull and junction boxes. Support independently from entering conduits and raceways. Provide supports as specified for conduits and raceways for outlet boxes and pull boxes 100 cubic inches and smaller.

Q. Provide supports sized for the ultimate loads to be imposed.

3.2 CLEANING

A. Clean surfaces to be painted.

END OF SECTION

SECTION 26 05 32

RACEWAYS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Work Included: Provide a mechanically and electrically complete conduit system.

B. Related work specified in other sections:

1. 26 00 00 - Electrical
2. 26 05 19 - Low Voltage Electrical Power Conductors and Cables
3. 26 05 29 - Hangers and Supports for Electrical Systems
4. 26 05 23 - Control Voltage Electrical Power Cables

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Product Data: If materials are by manufacturers other than those specified, submit product data giving complete description for sizes employed, material types, and installation methods.

C. Certificates:

1. Labels of Underwriters' Laboratories, Inc. affixed to each item of material.
2. If materials are by manufacturers other than those specified submit certification that material meets applicable Underwriters' Laboratories, Inc. Standards.
3. Labels of ETL Verified PVC-001 affixed to each PVC Coated Galvanized Rigid Conduit.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect conduits and finishes from damage.

1.6 MANUFACTURER

A. The materials shall be the products of a manufacturer with a minimum of ten years experience in the manufacture of similar equipment.

B. Acceptable Manufacturers

1. Metallic Conduits: Allied, and Wheatland.
2. Nonmetallic Conduits: Cantex, and SEDCO.

3. PVC Coated Metallic Conduits: Plastibond, Permacote, and Korkap.
4. Others: As listed with products.

1.7 WARRANTY

A. The materials shall be warranted to be in proper working condition for a period of one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rigid Metal Electrical Conduit: Hot-dipped galvanized steel with zinc coated threads and an outer coating of zinc bichromate, complete with one coupling and one end thread protector. Intermediate metal conduit (IMC) is not allowed.

B. Electrical Metallic Tubing: Welded, electro-galvanized thin wall steel tubing.

1. Conduit for power wiring shall be natural electro galvanized.
2. Conduit for other systems shall be color coded in accordance with Section 26 05 23 - Control Voltage Electrical Power Cables.

C. Flexible Metal Electrical Conduit: Hot-dipped galvanized steel strip core with integral copper ground wire on sizes 1-1/4" and smaller.

D. Liquidtight Flexible Metal Electrical Conduit: Hot-dipped galvanized steel strip core with extruded polyvinyl jacket.

E. Rigid Nonmetallic Electrical Conduit: Schedule 40 heavy wall polyvinylchloride, high impact resistant.

F. PVC Coated Galvanized Rigid Conduit: The PVC coated galvanized rigid conduit must be UL Listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standard may include: UL 6 Standard for Safety, Rigid Metal Conduit, UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

G. Elbows and Bends:

1. All Types: Size 1-1/4 inch and larger shall be factory manufactured.

H. Bushings:

1. 1-1/4" and Smaller: Same material as the conduit with which they are installed.
2. 1-1/2" and Larger: Hot-dipped galvanized with thermosetting phenolic insulation, 150 Deg.C.

I. Locknuts:

1. 1-1/2" and Smaller: Zinc plated heavy stuck st eel, O-Z/Gedney.
2. 2" and Larger: Cadmium plated malleable iron, O-Z/Gedney.

J. Hubs: Cadmium plated malleable iron, tapered threads, neoprene "O" ring, insulated throat, O-Z/Gedney.

K. E.M.T. Compression Connectors: Gland compression type, zinc plated steel body, cadmium plated, malleable iron nut, insulated throat, O-Z/Gedney.

L. E.M.T. Compression Couplings: Gland compression type, zinc plated steel body, cadmium plated malleable iron nut, O-Z/Gedney.

M. Liquidtight Conduit Connectors: Cadmium plated malleable iron body and nut, cadmium plated steel ferrule, insulated throat, integrally cast external ground lug, O-Z/Gedney.

N. Seals for Watertight Wall and Floor Penetrations: Malleable iron body, oversize sleeve, sealing ring, pressure clamp and rings and sealing grommet, hex head cap screws, O-Z/Gedney.

O. Seals for Penetrations through Existing Walls: Thunderline Corporation Link-Seal watertight sleeves, complete with wall and casing seals.

P. Fire Seals: Galvanized iron pipe sleeves sealed with approved foam type fireproofing.

Q. Expansion Fittings: Hot-dipped galvanized malleable iron with bonding jumpers selected for linear or linear with deflection, as required.

R. Escutcheons: Chrome plated sectional floor and ceiling plates, Crane No. 10.

S. Accessories: Reducers, bushings, washers, etc., shall be cadmium plated malleable iron on the forms and dimensions best suited for the application.

T. Identifying Tape for Underground Conduits: Polyethylene tape, 6 inches wide, with continuous printing along length, Brady Identoline:

1. For Electric Power Conduits: Yellow with black letters.
2. For Other Services: Green with black letters.

U. Sleeves: 22 gauge galvanized steel sleeves where conduits pass through walls and floors. Standard galvanized steel pipe where conduits pass through beams, outside walls, or structural members.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to which conduits are to be secured for:

1. Defects which will adversely affect the execution and quality of work.
2. Deviations from allowable tolerances for the building material.

B. Do not start work until defects and deviations are corrected.

3.2 INSTALLATION

A. Size conduits as indicated on the drawings and as required by the NEC for the number and sizes of wires to be drawn into conduit. Do not use conduit sized less than 3/4" unless specified otherwise.

B. Conceal conduits from view in all areas except mechanical and electrical equipment rooms and crawl spaces. Should it appear necessary to expose any conduit:

1. Bring to the attention of the Architect, immediately, and
2. Rearrange the work to facilitate an approved installation.

C. Install all conduits at elevations and locations to avoid interference with grading of other work, the structure, finished ceilings, walls. Avoid causing cutting of masonry units.

D. To prevent displacement, securely support and hold in place all conduits installed in advance of other work and to be concealed in the building structure.

E. Carefully lay out conduits run within the structure, such as floors, beams, walls, to avoid densities excessive for the construction. Relocate those conduits when excessive densities occur.

F. Ream, remove burrs, and swab inside conduits before conductors are pulled in.

G. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.

H. Bends and offsets in 1" and smaller conduits may be done with approved bending devices. Do not install conduits which have had their walls crushed and deformed and their surface finish damaged due to bending.

I. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best required for the application.

J. Make all conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in a manner to avoid creating moisture traps.

K. Install insulated throat threaded hubs on conduits entering enclosures without threaded hubs where exposed to damp or wet locations.

L. Connect and couple E.M.T. with compression type fittings. Do not use indentor and set screw fittings.

M. Install and neatly rack exposed conduits parallel with and perpendicular to the building walls. Do not install exposed diagonal conduit runs.

N. Route and suspend conduits crossing expansion joints to permit expansion, contraction, and deflection utilizing approved fittings to prevent damage to the building, conduits, and supporting devices in accordance with the National Electrical Code.

O. Do not run conduits exposed on the roof unless approval is obtained prior to installation.

P. Do not place conduits in close proximity to equipment, systems, and service lines, such as hot water supply and return lines, which could be detrimental to the conduit and its contents. Maintain a minimum 3" separation, except in crossing, which shall be a minimum 1".

Q. Connect motors, equipment containing motors, equipment mounted on an isolated foundation, and other equipment and devices which are subject to vibration and which require adjustment with flexible metallic conduit from the device to the conduit serving it. Size the flexible conduit length more than 12 diameters, but less than 18 diameters. Rigidly support the points of attachment on each side of the connection.

R. Install escutcheons on all exposed conduits passing through interior floors, walls, or ceilings. Install fire sealing materials on all conduits passing through fire rated partitions. Install wall and floor fire seals on all conduits passing through exterior walls and floors.

S. Conduit sleeves shall be sized to permit insertion of conduit with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, watertight fittings, as specified herein, shall be used.

T. Provide pullstring in each empty conduit. Label pullstring when conduit termination is not obvious.

U. All stubups of PVC conduit runs shall be made with rigid galvanized steel conduit with protective wrapping. Provide corrosion resistant protective wrapping from where the galvanized conduit begins to 4” above the finished floor.

3.3 USES PERMITTED

A. Rigid Metal Conduit:

1. Exterior conditions above grade.
2. Interior wet or damp locations.
3. Hazardous locations.
4. Central utility plant and mechanical equipment rooms.
    a. Sizes 2” and larger.
5. Lower Level of the building.
    a. Sizes 2” and larger.

B. Schedule 40 PVC with concrete encasement:

1. Below grade exterior to the building.

a. Electric Services.
b. Communications Services.
c. Sizes 2” and larger.

C. Schedule 40 PVC without concrete encasement:

1. Below grade interior to the building.

a. Electric services below floor slab.
b. Communications services below floor slab.

2. Below grade exterior to the building.

a. Sizes 1-1/2” and smaller.

D. Electrical Metallic Tubing:

1. All uses above grade interior to the building, except as limited elsewhere in this section.

E. Steel Armor Clad Cable:

1. Concealed in walls and above ceilings.
2. Final connection from junction boxes on structure to individual light fixtures. Fixture-to-fixture wiring not permitted.
3. Home runs from first junction box to panelboards shall be EMT.

F. Flexible Metal Conduit:

1. Final connection to vibrating or adjustable equipment.
2. Connection to vibrating equipment shall contain one 90 degree bend.

G. Liquid tight Flexible Metal Conduit:

1. All uses permitted for flexible metal conduit.

a. In damp or wet locations.
b. Exterior to the building.
c. Food service areas.
d. Central plant equipment rooms.

END OF SECTION

SECTION 26 05 33

BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 REFERENCE DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all of the Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Work Included: Provide outlet boxes for the installation of wiring devices, lighting fixtures, and power and control connections.

B. Related work specified in other section:

1. 26 00 00 - Electrical
2. 26 27 26 - Wiring Devices
3. 26 51 01 - Interior Lighting
4. 26 05 23 - Control-Voltage Electrical Power Cables

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 SUBMITTALS

A. Samples: Provide samples upon specific request.

B. Product Data: If materials are by manufacturers other than those specified, submit product data giving complete description for sizes employed, material types, and electrical ratings.

1.5 MANUFACTURERS

A. Listed with Materials.

1. Appleton Electric Company
2. Raco
3. Steel City
4. Crouse Hinds
5. Hubbell
6. Raceway Components
7. Walker

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flush Mounted Outlet Boxes: Standard, stamped galvanized steel with factory conduit knockouts, one piece and welded construction:

1. Series 4S and 4S0 square boxes with covers.
2. Series M1, M2, M3 - 250 and Series M1, M2, M3 - 350 masonry boxes with covers.
3. Series 2G and GC-5075 switch boxes with covers.
4. Series OCR concrete rings with Series OCP and OCP-3/8 back plates.
5. Series 40 and 40D octagonal boxes with raised covers.
6. Series SX expandable bar hangers.

B. Surface Mounted Outlet Boxes: Cast metal with threaded hubs. Type FS and FD of form suited to the application.

C. Fire Rated, Flush, Poke-Thru Outlets: Raceway Components, Inc. #RC-700A.

D. Fire Rated, Flush, Poke-Thru Outlets with Conduit Adapter: Raceway Components, Inc. #RC-700-6-A.

E. Floor Outlet Boxes: Hubbell cast flush floor boxes, fully adjustable with flush service fitting, and carpet flange (if required).

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine building structure to which outlet boxes are to be secured for defects which affect the execution and quality of work.

B. Do not start work until defects are corrected.

3.2 PREPARATION

A. Carefully measure and lay out exact locations in conference with the Construction Manager.

B. Owner may change outlet box locations a distance of 5 feet before rough-in without additional cost.

3.3 INSTALLATION

A. In dry walls for single and two gang outlet provide 4S and 4D boxes; for 3 or more outlets use masonry boxes.

B. In poured concrete floors, provide cast flush floor boxes complete with service fittings and carpet flanges (if required).

C. In existing concrete floors, provide fire-rated poke-thru outlets complete with wiring devices and other accessories (if required).

D. In block and masonry walls provide masonry boxes of depths required for wall thickness.

E. In poured concrete and plastered walls provide 4S and 4D boxes for single gauge outlets and 2G and 3G-5075 boxes for multiple ganged outlets.

F. In concrete ceiling provide OCR rings.

G. In other ceilings provide 40 and 40D boxes. Omit covers if standard canopy and device plates entirely cover the ceiling opening.

H. In exposed work, exterior of the building, in wet locations, and flush in non-waterproofed walls below grade provide FS and FD boxes.

I. Submit for approval special boxes for special devices and applications. Size according to device and application in accordance with NEC.

J. Install outlet boxes finished to within 1/8 inch of finished surfaces.

K. Install center of box at heights above finished floor:

1. Wall Switches: 45 Inches
2. Convenience Outlets: 18 Inches
3. Telephone/Data Outlets: 18 Inches
4. Wall Telephone Outlets: 45 Inches
5. Boxes Indicated Above Counters: 4 Inches above backsplash and trim, unless otherwise indicated.

L. Install wall switch outlet boxes on the strike side of doors as finally hung.

M. Group outlet on circuits with homeruns as indicated on the Drawings.

N. Do not provide through-the-wall and back-to-back boxes unless specifically noted on the drawings.

O. Provide standard manufactured plugs in unused openings of boxes.

P. Provide boxes at the terminal of conduit runs to outlets and devices.

Q. Provide plaster rings and covers where required by the building structure.

R. In brick finished walls, locate to work brick in a brick course where possible, and to permit conduits and raceways to enter from the rear without cutting brick, where possible.

S. Provide 3/8 inch studs and lighting fixture outlet boxes where shop drawings of fixtures require and elsewhere as may be required for fixtures.

T. Rigidly attach to structure and ceiling supporting members in suspended ceilings to avoid cutting mechanical ceiling members.

U. Center outlet in paneling and in other Architectural features.

V. Locate light fixture outlets in uniform relation with ceiling tiles.

W. Label all junction boxes with circuit information as to its use for special system equipment. Use an indelible marker to mark information on cover.

3.4 CLEANING

A. Clean surfaces to be painted.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 REFERENCE DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all of the Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Provide identification of electrical equipment.

B. Provide identification of over current devices.

C. Provide identification of branch circuits, outlets, and wiring devices.

D. Provide identification of required clear working spaces for electrical equipment.

E. Provide identification of rooms and spaces for access by qualified personnel.

F. Related work specified in other section:

1. 26 05 33 - Boxes for Electrical Systems.
2. 26 22 13 - Low Voltage Distribution Transformers.
3. 26 24 13 - Circuit Breaker Distribution Switchboards.
4. 26 24 16 - Panelboards.

1.3 QUALITY ASSURANCE

A. Signs and plackards shall meet the requirements by OSHA.

1.4 SUBMITTALS

A. Submit literature describing all signage and marking materials to the Architect for approval prior to installation.

PART 2 - PRODUCTS

2.1 LABELS

A. Labels shall be typewritten, adhesive backed printed labels. Lettering shall be minimum 18 point type in basic black font.

2.2 MARKING MATERIALS

A. Materials for marking of required working clearance shall be adhesive backed yellow tape, equal to 3M Company 471 Series. Clean and prepare floor surface in accordance with manufacturer’s instructions.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Provide other electrical and mechanical equipment with plackards identifying.

1. The name of the equipment.
2. The name of the supply source equipment.
3. The circuit number of the overcurrent device supplying the equipment.

3.2 OUTLET BOXES, JUNCTION BOXES AND WIRING DEVICES

A. Provide labels affixed to the inside cover for each outlet box, junction box, and wiring device identifying the panel name and branch circuit numbers for the overcurrent devices supply the circuits.

END OF SECTION

SECTION 26 22 13

LOW VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for Coordination of work with other portions of the work.

1.2 DESCRIPTION

A. Work Included: Provide low voltage distribution power transformers for the conversion of system voltages.

B. Related Work specified in other sections:

1. 26 00 00 Electrical
2. 26 28 16 Enclosed Switches and Circuit Breakers
3. 26 05 26 Grounding and Bonding for Electrical Systems

1.3 QUALITY ASSURANCE:

A. The equipment provided shall meet the requirements of the National Electrical Code and local codes and ordinances.

B. The equipment provided shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 REFERENCED STANDARDS

A. NEMA ST-20 Dry Type Transformers for General Applications

B. NEMA TP-1 Department of Energy, 10 CFR Part 431 Energy Efficiency

C. UL 1561 Dry Type General Purpose and Distribution Transformers

D. ANSI C57.110 IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment

1.5 SUBMITTALS

A. Submit manufacturer’s literature describing equipment for each transformer, including:

1. Outline dimensions.
2. Weight.
3. Allowable conduit entry locations.
4. 1/4" scale layout of proposed equipment location including required working clearances and interference with other equipment.
5. Primary and secondary terminal locations.
6. Cable connection lugs and sizes.
7. Nameplate data and phase diagram.

8. Primary voltage, phase, connections and full load current.
9. Secondary voltage, phase, connections, and full load current.
10. KVA rating.
11. Transformer impedance.
12. Designed supports for wall mounted or suspended transformer supports, prepared by a professional structured engineer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and off loaded in accordance with the manufacturer's published instructions.

B. Upon arrival, inspect equipment for damage incurred in shipping.

C. Store and protect equipment from moisture and dust by storing in a clean, dry, heated space. Provide additional heavy plastic cover to protect the equipment and components. Provide auxiliary heating in the section in accordance with the manufacturer's recommendations.

1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with manufacture of similar equipment.

B. Acceptable Manufacturers:

1. Square D Company
2. General Electric
3. Eaton, Cutler-Hammer

1.8 WARRANTY

A. The equipment shall be warranted to be in proper working order for a period of one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

A. Transformers shall be general purpose dry type ventilated transformers in NEMA 1 enclosures unless specifically noted on the drawings.

B. Transformers shall be of the KVA rating, primary voltage and connection, secondary voltage and connection as indicated on the drawings.

C. All insulating materials shall meet NEMA ST20 standards and be rated for 220 Deg.C. insulation system. Transformers shall be designed for 150 Deg.C. temperature rise and maximum temperature of the top of the enclosure of 50 Deg.C., based on an ambient air temperature of 40 Deg.C.

D. Transformers 25 KVA and larger shall be provided with full rated primary voltage taps, two 2-1/2% below nominal voltage and two 2-1/2% above nominal voltage.

2.2 CONSTRUCTION

A. Coils shall be continuous wound aluminum conductor with windings brazed or welded to line and load terminations. Windings shall be vacuum impregnated with thermosetting varnish.

B. Cores shall be constructed of high grade silicon steel with low hystresis and eddy current losses. The core flux density shall be below saturation point to prevent core overheating. Transformers shall be common core, multiple core construction and Scott-T connections are not acceptable.

C. Enclosures shall be ventilated and fabricated of code gauge steel construction. Entire enclosure shall be finished with a baked polyester powder coat paint finish, ANSI 49 gray. The coating shall be U.L. recognized for outdoor use. All terminals and tap connections shall be accessible by removing a front cover plate.

D. Core and coil shall be bolted to the base of the enclosure by means of rubber vibration isolation mounts.

E. The core of the transformer shall be grounded to the enclosure by a flexible grounding conductor sized in accordance with U.L. and NEC standards.

F. The transformer shall be provided with a name plate giving primary and secondary voltages, full load ampacities, transformer impedance and phaser diagram.

2.3 SOUND LEVELS

A. Sound levels shall not exceed the following:

1. 15 to 50 KVA - 39dB
2. 51 to 112.5 KVA - 44dB
3. 112.5 to 300 KVA - 49dB
4. 301 to 500 KVA - 56dB

2.4 OUTDOOR INSTALLATIONS

A. For outdoor installations, transformers shall be provided with weather shield for NEMA 3R enclosure designation.

2.5 K-RATED TRANSFORMERS

A. Where specifically noted on the drawings, K-Rated transformers shall be rated K-13, shall be provided with 200% neutral bus and neutral conductor terminations, and shall be provided with an independent, full width electrostatic grounded shield between primary and secondary windings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Layout exact locations of transformers maintaining required working access, separation from walls, and adequate space for line and load connections as required by NEC.

B. Transformers shall be floor mounted on four inch concrete housekeeping pads with inserts for anchor bolts.

C. Transformers may be mounted on wall brackets from building structure or suspended from the floor or roof structure above only when supports designed by a professional structural engineer are submitted to the project engineer for approval.

3.2 INSTALLATION

A. Transformers installed in a location where the primary over current device does not comply with NEC requirements for a disconnecting means shall be provided with a heavy duty non-fused disconnect switch or molded case switch in a suitable enclosure.

B. Transformers installed in a location where secondary circuit conductors are in excess of NEC maximum length shall be provided with a heavy duty fused disconnect switch or molded case circuit breaker in suitable enclosure to provide secondary feeder circuit protection.

C. All transformers shall be installed on suitable neoprene vibration isolation pads to minimize transmission of noise to structure.

D. Final connection of raceways to transformers shall be by means of flexible liquid tight metal conduit approximately twelve inches in length incorporating one ninety degree bend to minimize the transmission of vibration to the raceway system.

3.3 GROUNDING

A. Ground transformer secondary to building structural steel or other approved grounding electrode with a grounding electrode conductor in accordance with NEC requirements.

B. Bond the transformer grounded circuit conductor (neutral) to the grounding electrode conductor on the line side of the transformer secondary over current device.

3.4 ADJUSTMENT

A. Adjust transformer primary taps to provide nominal name plate secondary voltages when operating at full demand capacity without over-excitement of the primary winding or over-saturation of the transformer core.

3.5 IDENTIFICATION

A. Provide a permanently affixed engraved nameplate for each transformer giving the transformer name, the source of supply, and the name of the panel or equipment served.

END OF SECTION

SECTION 26 24 13

CIRCUIT BREAKER DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Provide low voltage distribution switchboards for the distribution of electric power and protection of load feeder circuits.

B. Related work specified in other sections

1. 26 00 00 - Electrical
2. 26 43 13 - Surge Protection Devices

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 REFERENCED STANDARDS

A. ANSI/NFPA 70 - National Electrical Code (NEC).

B. ANSI/IEEE C12.1 - Code for Electricity Metering.

C. ANSI C39.1 - Electrical Analog Indicating Instruments.

D. ANSI C57.13 - Instrument Transformers.

E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

F. NEMA KS 1 - Enclosed Switches.

G. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681

H. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

I. NEMA PB 2.2 - Application Guide for Ground Fault Protective Devices for Equipment.

J. UL 50 - Cabinets and Boxes.

K. UL 98 - Enclosed and Dead Front Switches.

L. UL 489 - Molded Case Circuit Breakers.

M. UL 891 - Dead-Front Switchboards.

N. UL 943 - Ground Fault Circuit Interrupters.

O. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

P. UL 977 - Fused Power Circuit Devices.

1.5 SUBMITTALS

A. Submit Shop Drawings Including:

1. Front View Elevation
2. Plan View
3. Top View
4. Single Line Diagram
5. Nameplate Schedule
6. Conduit Entry/Exit Locations and Dimensions
7. 1/4" scale layout of proposed location for equipment including required working clearances and interferences with other equipment.
8. Assembly Ratings Including
    a. Main Bus Ratings
    b. Main Lugs or main breaker ratings and location
    c. Voltage ratings
    d. Section Bus Ratings
    e. Ground Bus Ratings and Locations
    f. Short-circuit Ratings
9. Cable Terminal sizes.
10. Switchboard instrument details:
    a. Current transformer data, ratings, accuracy, burden and locations.
    b. Potential connections and location.
    c. Meter descriptive literature and functions.
    d. Control wiring diagrams and field terminal connection locations.

B. Submit manufacturer’s literature describing circuit breakers and trip units for each type and frame employed.

C. Submit manufacturer’s literature for metering equipment, current transformers, potential connections, and wiring diagrams.

1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and off loaded in accordance with the Manufacturer’s published instructions.

B. Upon arrival, inspect equipment for damage incurred in shipping.

C. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

F. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with the manufacture of similar equipment.

B. Acceptable Manufacturers:

1. Square D Company.
2. General Electric.
3. Eaton.

1.8 WARRANTY

A. The equipment shall be warranted to be in proper working order for a period of one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 SWITCHBOARD - GENERAL

A. Switchboards supplied by building service transformers shall be provided with neutral to ground disconnecting links and U.L. Service Entrance Labels. Provide and install permanent name plate showing date of service and available utility fault current. Obtain available fault current in writing from utility company in project record documents.

B. Short Circuit Current Rating: Switchboards shall be rated with a short circuit current rating as indicated on the drawings, or a minimum of 65,000 A.I.C.

C. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

D. Enclosure: NEMA 1 - General Purpose.

1. Sections shall be completely front and rear aligned. Staggered arrangements are not acceptable.
2. The switchboards shall be of dead front construction.
3. The switchboard frame shall be of formed steel rigidly bolted together to support all cover plates, bussing and component devices during shipment and installation.
4. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
5. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit.
6. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be ANSI #49 medium-light grey, applied by the electro-deposition process over an iron phosphate pre-treatment.
7. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
8. Top and bottom conduit areas shall be clearly indicated on shop drawings.

E. Nameplates: Provide 1" H X 3" W engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.

F. Bus Composition: Shall be plated aluminum. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans and shall be sized to carry 100% of that ampacity. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus shall not be acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

G. Bus Connections: Shall be bolted with Grade 5 bolts and conical spring washers.

H. Ground Bus: Sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.

I. Accessibility: Accessible from the front only.

2.2 SWITCHBOARD DEVICES

A. Main Breaker

1. Electronic Trip Insulated Case Circuit Breaker

a. Fixed Mounting, Two-Step Stored Energy:

1) Circuit breaker(s) shall have power terminals to accommodate either cable or bolted bus connections.
2) Circuit protective devices shall be two-step stored energy circuit breaker. They shall be UL Listed for 100% continuous current when applied in switchboards. Sensor ampere ratings shall be as shown on the drawings.
3) Provide a fixed instantaneous circuit on breaker(s). The circuit shall have a defeatable instantaneous adjustment to allow the breaker to remain closed for up to 30 cycles during overcurrents below the rms symmetrical short time withstand ratings. The circuit shall instantaneously trip when current levels exceed applicable withstand ratings.
4) Circuit breaker(s) shall utilize a glass reinforced insulating material providing high dielectric strength. Current carrying components shall be completely isolated from the handle and the accessory mounting area. Breaker(s) shall have common tripping of all poles and shall be trip free. The circuit breaker shall be UL Listed for reverse connection without requiring special construction or labeling. The breaker(s) shall have quick-make, quick-break contacts with a maximum 5 cycle closing time. All circuit breakers shall be equipped with electrical accessories as noted on the drawings.
5) Circuit breaker(s) shall be factory sealed and shall have a date code on the face of the circuit breaker. Poles shall be labeled with respective phase designations.
6) Breaker faceplate shall indicate rated ampacity. Breaker faceplate shall indicate UL and IEC certification standards with applicable voltage systems and corresponding AIC ratings.
7) Each circuit breaker shall be equipped with a push-to-trip button to mechanically operate the circuit breaker tripping mechanism.
8) Electronic Trip System

a) The entire trip system shall be a microprocessor-based, true rms sensing design with sensing accuracy through the 13th harmonic, equal to type MICROLOGIC full function trip system.
b) Provide the following time/current curve shaping adjustments to maximize system selective coordination. Each adjustment shall have discrete settings and each function is independent from all other adjustments.
(1) Adjustable Long Time Ampere Rating and Delay
(2) Adjustable Short Time Pickup and Delay (delay includes I^2t IN and I^2t OUT)
(3) Adjustable, Defeatable Instantaneous Pickup (with OFF position)
(4) Adjustable Ground Fault Pickup and Delay (delay includes I^2t IN and I^2t OUT)
(5) High Level Selective Override

9) Circuit breaker shall display phase current of A, B, and C phases and ground fault (when applicable) in real-time. Circuit breaker shall contain trip indicators which shall indicate that the circuit breaker has tripped as a result of over current, short circuit, or ground fault.

B. Branch Circuit Breakers

1. Electronic trip molded case standard function 80% rated circuit breakers.

a. Group mounted through 1200 amperes.
b. Individually mounted above 1200 amperes. Each circuit breaker shall have power terminals to accommodate either cable or bolted bus connections.
c. Electronic Trip System

1) The entire trip system shall be a microprocessor-based, true RMS sensing design with sensing accuracy through the 13th harmonic, equal to MICROLOGIC full function trip system.
2) Provide the following time/current curve shaping adjustments to maximize system selective coordination. Each adjustment shall have discrete settings and each function is independent from all other adjustments.

a) Adjustable Long Time Ampere Rating and Delay
b) Adjustable Short Time Pickup and Delay (delay includes I^2t IN and I^2t OUT)
c) Adjustable, Defeatable Instantaneous Pickup (with OFF position)
d) High Level Selective Override

3) Each circuit breaker shall be capable of being removed from the front of the switchboard.

2.3 INSTRUMENTATION

A. With the main circuit breaker, provide a Square D PowerLogic PM5000 series meter with the following characteristics:

1. Current/Voltage Inputs

a. The meter shall have no less than 4 voltage inputs and 5 current inputs
b. The meter in its standard configuration shall be able to accept 600VAC without using potential transformers.
c. The meter shall be able to withstand 1500 VAC RMS continuously.
d. The meter shall support nominal current ratings of 1A, 2A, 5A, 10A, and/or 20A.

2. Provide at minimum the following voltage & current values:

a. Voltage L–L Per-Phase, L-L 3-Phase Avg, L–N Per-Phase, 3-Phase Avg, Voltage % unbalanced
b. Current values: Current Per-Phase, Current, Neutral (measured), Current 3-Phase Avg, Current % Unbalanced.
c. Power & energy values:
- Real Power (Per-Phase, 3-Phase Total)
- Reactive Power (Per-Phase, 3-Phase Total)
- Apparent Power (Per-Phase, 3-Phase Total)
- Power Factor – True (Per-Phase, 3-Phase Total)
- Power Factor – Displacement (Per-Phase, 3-Phase Total
- Accumulated Energy (Real kWh, Reactive kVARh, Apparent kVAh)
- Incremental Energy (Real kWh, Reactive kVARh, Apparent kVAh)
- Conditional Energy (Real kWh, Reactive kVARh, Apparent kVAh)
- Reactive Energy by Quadrant

2.4 SURGE SUPPRESSION DEVICE (SPD)

A. Provide SPD protection externally mounted to the switchboard specified in Section 26 43 13, Surge Suppression Devices.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine area to receive switchboard to provide adequate clearance for switchboard installation.

B. Check that concrete pads are level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in accordance with manufacturer's written guidelines, the NEC, and local codes.

3.3 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure, using a Megger, the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 VDC; minimum acceptable value for insulation resistance is 1 megohms. NOTE: Refer to manufacturer's literature for specific testing procedures.

C. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque values.

D. Physically test key interlock systems to check for proper functionality.

E. Test ground fault systems by operating push-to-test button.

3.4 IDENTIFICATION

A. Provide engraved switchboard nameplate permanently affixed to main lug or main breaker section cabinet giving switchboard name designation, system voltage, and name of switch board supply source.

B. Provide each branch or feeder device with LN engraved nameplate permanently affixed to the cabinet adjacent to the device giving the name of the load served.

1. Spare devices or devices for future loads shall be so identified.
2. Spaces prepared for future devices shall be so identified, along with the maximum ampere rating or frame size the prepared space can accept.

C. Provide identification in accordance with Section 26 05 53 - Identification for Electrical Systems.

D. Provide permanent identification for low voltage, control, metering, and instrumentation terminal blocks and individual terminals.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturers specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values as instructed by the Engineer.

3.6 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

B. Throughout the construction period, maintain switchboard and interior free of duct, debris, wire trimmings, etc. Provide heavy duty plastic barriers as required.

C. Before final acceptance thoroughly clean switchboards and interiors and vacuum clean to a dust free condition.

3.7 TRAINING

A. Provide eight hours of training for the Owner’s personnel in the operation and maintenance of the equipment.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Provide lighting and appliance branch circuit panelboards, circuit breakers and accessories.

B. Related work specified in other sections:

1. 26 00 00 - Electrical

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 REFERENCED STANDARDS

A. NEMA PB 1 - Panelboards

B. NEMA PB1.1 - Instructions for Sate Installation, Operation and maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. UL 50 - Enclosures for Electrical Equipment

F. UL 67 - Panelboards

G. UL 98 - Enclosed and Dead-front Switches

H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

I. Federal Specification W-P-115C - Type Class 1

J. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

1.5 SUBMITTALS

A. Submit Shop Drawings including:

1. Voltage Ratings.
2. Main lug or breaker rating and location voltage ratings.
3. Main Bus Rating.
4. Neutral Bus Rating and location.

5. Ground Bus Rating and location.
6. Thru-feed or sub-feed lug ratings and location.
7. Overall Panelboard Dimensions.
8. Interior Mounting Dimensions.
9. 1/4" scale layout of proposed equipment location including required working clearances, interference with other equipment and available recessing depth where applicable.
10. Location and arrangement of branch breakers.
11. Number of poles, trip ratings, and interrupting ratings of branch breakers.
12. Top and bottom conduit entries and knockouts.
13. Enclosure NEMA Type.
14. Panel deadfront, trim, door, hinge and locking provisions.
15. Manufacturer's literature describing circuit breakers and trip units for each type and frame employed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be included and off loaded in accordance with the manufacturer's published instructions.

B. Upon arrival, inspect equipment for damage incurred in shipping.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

D. Conform to NEMA PB2 service conditions during and after installation of panelboards.

1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with the manufacturer of similar equipment.

B. Acceptable Manufacturers:

1. Square D Company.
2. General Electric.
3. Eaton.

1.8 WARRANTY

A. The equipment shall be warranted to be in proper working prder for a period of one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

A. Interior:

1. Shall be equal to Square D type NF panelboard for 480 volt and Square D NQOB for 208 volt. Continuous main current ratings, as indicated on drawings.
2. Minimum Short Circuit Rating:

   a. 65,000 rms symmetrical amperes at 480Y/277 or as indicated on the Drawings.
   b. 25,000 rms symmetrical amperes at 208Y/120 or as indicated on the Drawings.
   c. All panelboard components shall be fully rated for the required short circuit interrupting rating. Series rating of devices is not permitted.

3. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current rating shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated aluminum. Bus bar plating shall run the entire length of the bus bar.

Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.

4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
5. A solidly bonded aluminum equipment ground bar shall be provided. An additional aluminum isolated/insulated ground bar shall also be provided as indicated on the Drawings.
6. UL Listed panelboards with 200% rated solid neutral shall be plated aluminum for non-linear load applications. Panelboards shall be marked for non-linear load applications.
7. Interior trim shall be dead-front construction to shield user from energized parts. Dead-front trim shall have filler plated covering unused mounting space.
8. Nameplate shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA/UL Listed label ans short circuit current rating shall be displayed on the interior or in a booklet format.
9. Interiors shall be field convertible for top or bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
10. Interior phase bus shall be pre-drilled to accommodate field installable options (i.e., Sub-Feed Lugs, Sub-Feed Breakers, and Thru-Feed Lugs).
11. Interiors shall accept 125 ampere breakers in group mounted branch construction.

B. Main Circuit Breaker

1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40 Deg.C. ambient environment. Thermal elements shall be ambient compensating above 40 Deg.C.
2. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located in the front of the breaker that allows the user to simultaneously select the desired trip level all poles.
3. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breaker shall be CSA and UL Listed for reverse connection without restrictive line or load markings.
4. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
5. Lugs shall be UL Listed to accept solid or standard copper and aluminum conductors. Lugs shall be suitable for 75 Deg.C. eated wire.
6. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

C. Branch Circuit Breakers

1. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.
2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
3. Circuit breakers shall have an overcurrent toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles
4. The exposed faceplates of all branch circuit breakers shall be flush with one another.
5. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 Deg.C. rated wire.
6. Breakers shall UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
7. Breaker shall be UL Listed with the follow ratings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), (15-20A) Switch Duty (SWD), (15-50A) Equipment Protection Device (EPD) (480Y/277Vac maximum).

D. Enclosures

1. Type 1 Boxes

a. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel not acceptable.

b. Boxes shall have removable endwall with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
c. Box width shall not exceed 20" wide.

2. Type 1 Fronts

a. Front shall meet strength and rigidity requirements per UL 50 Standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
b. Mounting shall be flush or surface as indicated on the Drawings.
c. Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
d. Fronts shall be hinged door-in-door construction with front trim connected to enclosure with continues piano hinge and latch to access all wiring and termination without removing the door from the enclosure. A separate door, hinge and latch shall be provided to access the deadfront compartment to provide access to main and branch breaker operating handles with no exposure to energized parts.

3. Type 3R, 5 and 12

a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
b. All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One 91) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
c. Maximum enclosure dimensions shall not exceed 21" wide and 9.5" deep.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with manufacturer’s written instructions, NEMA PB 1.1 and NEC standards.

B. Provide panelboard supports to the building structure independent of raceways.

3.2 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer’s written specifications.

3.3 IDENTIFICATION

A. Provide engraved panelboard nameplate permanently affixed to the panel boor, giving panelboard name designation, system voltage, and name of the panelboard supply source.

B. Provide a neatly typewritten circuit directory card in card holder inside panel door describing the name and location of devices served by each branch breaker using numbers finally established at the project.

3.4 FUTURE PROVISIONS

A. From each flush mounted panelboard section, provide a minimum of two 1" conduits stubbed into the accessible ceiling and/or crawl space, as may be available, for future branch circuit wiring.

B. Provide a pull cord in all future conduits with identifying tags on both ends.

3.5 COORDINATION OF LOADS SERVED

A. Confirm that all branch circuit breakers are of the proper type and configuration for the loads finally connected:

1. HCAR Rated.
2. HID Rated.
3. GFCI Rated.
4. AFCI Rated.
5. Three pole common trip breakers for multi-wire branch circuits.

B. Reconnect loads, rearrange branch circuit breakers of provide new breakers as required to insure branch circuit breakers are proper type and properly rated for the loads finally connected.

3.6 CLEANING

A. Throughout the construction period, maintain panelboards and interiors free of dust, debris, wire trimmings, etc. Provide heavy duty plastic barriers as required.

B. Before final acceptance, thoroughly clean panelboards and interiors and vacuum clean to a dust free condition.

3.7 TRAINING

A. Provide eight hours of training for the Owner’s personnel in the operation and maintenance of the equipment.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 REFERENCE DOCUMENTS

A. Conditions of the Contract and Division 01 - General Requirements are hereby made a part of this section.

B. All sections of this specification.

1.2 DESCRIPTION

A. Work Included: Provide cabinets for the installation of wiring and equipment.

B. Related work specified in other section:

1. Electrical: Section 26 00 00
2. Panelboards: Section 26 24 16
3. Enclosed Switches and Circuit Breakers: Section 26 28 16
4. Control Voltage Electrical Power Cables: Section 26 05 23

1.3 QUALITY ASSURANCE

A. Source Quality Control: Tests to meet applicable Underwriters' Laboratories, Inc. Standards.

B. Reference Standards:

1. Underwriters' Laboratories, Inc. applicable Standards.
2. National Electrical Code.

C. Design Criteria: National Electrical Manufacturer's Association construction types based on environment.

1. Indoor: NEMA Type 1
2. Outdoor: NEMA Type 3R

1.4 SUBMITTALS

A. Shop Drawings shall include dimensions, knockout sizes and locations, material types and gauges, finishes, and installation methods.

B. Certificates shall include labels of Underwriters' Laboratories, Inc., and National Electrical Manufacturer's Association affixed to each item.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D

B. General Electric

C. Eaton

2.2 MATERIALS

A. For Panelboards:

1. Same manufacturer as panelboard, boxes of code gauge steel, welded with edges turned to receive trim, and galvanized.
2. Trim and doors No. 12 gauge steel minimum, hinged door, flush tumbler lock and catch keyed alike throughout the work, factory enamel finish, suitable for field color coat.
    a. Flush: Overlap minimum 3/4 inches top, bottom, and sides.
    b. Surface: Same size as cabinet.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine structure to which cabinets are to be secured for defects which affect the execution and quality of work.

B. Do not start work until defects are corrected.

3.2 PREPARATION

A. Carefully measure and lay out exact locations.

B. Provide supports.

3.3 INSTALLATION

A. Provide cabinets where indicated and where necessary.

B. Provide flush type in finished areas centered in paneling and other Architectural features.

C. Provide surface type in equipment rooms, above accessible finished ceilings, and in crawl spaces.

D. Install lighting and power cabinets with tops 6 feet 6 inches above finished floor.

E. Install cabinet trim and doors straight and plumb.

3.4 CABINET IDENTIFICATION

A. Cabinets for all panelboards, switchboards, disconnect switches, transformers, motor starters, and electrical equipment furnished shall be provided with engraved phenolic lamacoid plastic name plates with 1/2 inch block engraving.

B. Name plates shall give equipment designation as scheduled on the drawings, circuit number designation, and voltage and phase of service.

3.5 ADJUSTMENT AND CLEANING

A. Adjust trims and doors for vertical and horizontal alignment.

B. Clean surfaces to be painted.

END OF SECTION

SECTION 26 51 01

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Work Included: Provide LED lighting fixtures and accessories for interior illumination of the building.

B. Related work specified in other Sections:

1. 26 00 01 General Provisions
2. 26 05 19 Low Voltage Electrical Power Conductors and Cables
3. 26 05 29 Hangars and Supports for Electrical Systems
4. 26 05 32 Raceways
5. 26 05 33 Boxes for Electrical Systems
6. 26 51 05 Lighting Controls

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

C. Laboratory Testing: Photometric testing shall be by Independent Testing Laboratories, Inc., based on Illuminating Engineering Society published procedures, and shall include candlepower distribution tabulation and zonal cavity coefficient of utilization tabulation.

1.4 REFERENCE STANDARDS

A. Underwriters' Laboratories No. 57 - Fixtures, Electric Lighting.

B. Underwriters’ Laboratories No. 924 - Emergency Lighting and Power Equipment.

C. Underwriters’ Laboratories No. 1598 - Luminaires

D. Underwriters’ Laboratories No. 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

1.5 SUBMITTALS

A. Submit manufacturer's literature giving materials, finishes, dimensions, coefficients of utilization, and lamp types for each fixture which is the product of one of the listed acceptable manufacturers.

B. Submit large scale shop drawings and copies of independent testing laboratory test report, along with manufacturer's literature for each fixture which is the product of any manufacturer not listed as acceptable.

C. Submit samples of fixtures upon specific request.

D. Certificates: Labels of Underwriters' Laboratories, Inc.; affixed to each item of material.

1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be included and off loaded in accordance with the manufacturer's published instructions.

B. Upon arrival, inspect equipment for damage incurred in shipping.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years' experience with the manufacturer of similar equipment.

B. Listed in schedule and with materials.

1.8 WARRANTY

A. The equipment shall be warranted to be in proper working order for a period of one year following the date of final acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lighting Fixtures:

1. Fixtures shall be of the lighting fixture types scheduled on the drawings according to the letter type designations on the plans.
2. If letter type designation is omitted from any fixture shown on the plans, provide the same fixture type as employed in rooms of similar usage.
3. Where manufacturer's model numbers are used to describe fixtures, the intent is to establish the kind and quality of the fixture. The Contractor is responsible for examining the drawings to establish correct ordering information for each fixture including but not limited to voltage for the branch circuit supply, ceiling trim and mounting means for the ceiling material.

B. Exit Signs:

1. Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

C. LED Source Package Lamps:

1. LED fixtures, source packages, arrays or modules and power supplies shall be UL 1598 and 2043 listed.
2. LED source packages, arrays or modules and power supplies shall be tested in accordance with LM-79/LM80.
3. LED light source packages, arrays or modules shall be tested in accordance with LM-80 depreciation test and L70 rated life result shall be a minimum of 50,000 hours.
4. LED lamp color temperature of 4000K with minimum 80% CRI is required for LED lamps. Lamp lumen minimum values as scheduled.
5. Luminaire power factor shall be minimum 90%.
6. LED fixtures, source packages, arrays or modules and power supplies shall be Design Lights Consortium (DLC) qualified.

D. LED Power Supplies/Drivers:

1. LED power supplies shall operate LEDs within the current limit specification of the manufacturer.
2. Shall operate from 60 Hz input source and have input power factor >90% and a minimum efficiency of 70% at full rate load of the driver.
3. Shall have short circuit and overload protection.
4. Shall have a minimum starting temperature of 0°F and a maximum case temperature rating of at least 70°F.
5. Power supply output shall be regulated to ±5% across published load range.
6. Shall have as Class A sound rating.
7. Shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47CFR part 15, non-consumer (Class A) for EMI/RFI.
8. Shall contain no PCBs.
9. Shall carry a five (5) year minimum warranty from date of manufacturer against defects in materials or workmanship, including a replacement for operation at or below the maximum case temperature specification. For LED lamps and internal power regulation components for defects resulting in a fixture lumen depreciation >30%.
10. Dimmable power supplies shall allow the light output to be maintained at the lowest control setting (prior to off) without dropping out.

E. Emergency Lighting Units with Battery Packs:

1. Self-contained units complying with UL 924.
    a. Battery: Sealed, maintenance-free, lead-acid type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
    g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

F. LED Source Package Lamps:

1. LED fixtures, source packages, arrays or modules and power supplies shall be UL 1598 and 2043 listed.
2. LED source packages, arrays or modules

G. Lighting Fixture Support Components:

1. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
2. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
3. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
4. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
5. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
6. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
7. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

H. Accessories: Manufacturers' standard mounting ring, trim flanges, hanger bars, spacers, supports, plaster frames of non-ferrous material or cadmium plated steel. Do not use painted steel plaster frames.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect Architectural drawings and specifications, including ceiling alternates, to determine ceiling material to be installed.

B. Inspect Architectural reflected ceiling plans.

C. Inspect installed ceiling components and pole bases for defects affecting the quality and execution of work.

3.2 PREPARATION

A. Verify ceiling material, type, support method and alignment.

B. Layout exact locations of fixtures in accordance with reflected ceiling plans, fixtures' and switches' outlet boxes and supports, and poles and standard bases.

C. Provide specified outlet boxes and conduit system for the light fixtures including conduit support system.

D. All lighting fixtures shall be supported from building structure. Do not support lighting fixtures from the ceiling system. Fixtures shall be supported by supplementary hangars located within 6 inches of each corner, or supported independently from the structure. Do not support lighting fixtures from other building systems located above the ceiling such as fire sprinkler piping, HVAC piping, plumbing piping, equipment or ductwork.

3.3 INSTALLATION

A. Provide lighting fixtures, control systems and wiring.

B. If designation omitted on drawings, provide same type fixtures employed in rooms of similar usage.

C. Provide spacers for fixtures mounted on low density ceiling material.

D. Provide plaster frames for recessed fixtures in plaster or gypboard ceilings.

E. Install fixtures in and on acoustical tile ceilings in alignment with tile joints.

F. Install fixtures in gypsum board ceilings to recess in the space available between structural members where the ceiling is installed tight against the structure.

G. Install in accordance with manufacturer's instructions, submittal data, and details on the drawings.

3.4 ADJUSTMENT AND CLEANING

A. Adjustment: Adjust lamp positions for desired effects. Align fixtures with building walls and tile joints.

B. Cleaning: Remove dirt, grease, and foreign materials from fixtures. Remove fingerprints, smudges, and dirt from fixture's lenses and lamps.

3.5 LIGHTING FIXTURE SCHEDULE

A. Reference drawings for Lighting Fixture Schedule.

END OF SECTION

SECTION 26 51 05

LIGHTING CONTROLS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Work Included: Provide a distributed, low voltage lighting control system with networked devices.

B. Related work specified in other Sections:

1. 26 00 00 Electrical
2. 26 05 19 Low Voltage Electrical Power Conductors and Cables
3. 26 95 32 Raceways
4. 26 05 33 Boxes for Electrical Systems
5. 26 51 01 Interior Lighting

1.3 QUALITY ASSURANCE

A. Factory Assembly: All system components shall arrive at the job site completely pre-wired and ready for installation, requiring only the connection of lighting circuits and network terminations. All connections shall be made to clearly and permanently labeled termination points. Systems that require field assembly shall not be acceptable.

B. Component Testing: All system components and assemblies shall be individually tested prior to assembly. Once assembled, all finished products shall be tested for proper operation of all control functions per specifications prior to shipment.

C. NEC Compliance: All system components shall comply with all applicable sections of the National Electrical Code (NEC) as required.

D. NEMA Compliance: All system components shall comply with all applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

E. UL Approval: All applicable equipment shall be tested to and listed under UL standard 508 and shall bare labels to indicate compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurance. System listed other ETL or other UL sections shall provide documentation proving compliance with UL standard 508.

1.4 SUBMITTALS

A. Submittals shall include, but not be limited to, the following:

1. Product data on all lighting control system components and accessories.
2. Reflected ceiling plan drawings showing specific locations of occupancy sensors for lighting control including lines delineating sensor effective range, with and without furniture system partitions, sensor type, sensor mounting, and other pertinent data to allow evaluation of the proposed system.
3. Wiring diagrams for occupancy sensors, related control units, and override switches including an overall system riser diagram.

4. Make submittals in accordance with Division 01.
5. Submit factory approved lighting controls layout showing all devices and proposed devices locations.

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver devices and cover plates in manufacturer's sealed unopened packages and protect from the introduction of dust and moisture.

B. Do not install sensors and cover plate until adjacent finishes are complete and the area has been cleaned to a dust free dry environment.

1.6 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with the manufacture of similar equipment.

B. Acceptable Manufacturer

1. Acuity
2. Hubbell
3. Lutron
4. Siemens
5. Wattstopper

1.7 WARRANTY

A. Provide a five year parts and one year labor warranty. Warranty coverage shall begin at the time of Project Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Summary:

1. The lighting control system specified in this section shall occupancy sensor-based and manual lighting control
2. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed). Specific dimmers will be capable of "dimming lights to off".
3. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function independently.
4. The system shall not require any centrally hardwired switching equipment.

B. System Requirements:

1. System must interface directly with intelligent LED luminaires such that only plenum rated CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see Networked LED Luminaire section).
2. Intelligent lighting control devices shall communicate digitally, require <7 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.
3. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
4. Devices within a lighting control zone shall be connected with plenum rated CAT-5e low voltage cabling in any order.

2.2 Digital Room Controller

A. As indicated and where shown on the plans, install room controllers to control the quantity of lighting and plug loads required.

B. Room controllers shall provide 0 - 10 volt dimming capability for the required number of lighting loads.

C. Room controllers shall integrate the functionality of connected control components including wall switch stations, occupancy sensors and daylight sensors to provide the required sequence of operation for the space.

D. Room controllers and associated room control components shall operate in a totally stand alone mode and not require the use of a network, software, computer or server for local control and time based functions.

E. Functional:

1. Provide an integral pushbutton and LED indicator for each load for status and to allow operation of the relays and dimmers for testing and verification without requiring other control devices to be connected.
2. The room controller shall have a default operation providing an automatic logical sequence of operation for each load as the room control devices are plugged into the Smart Port connectors.
3. Default operation for occupancy sensors shall be automatic on, automatic off for all loads.
4. Upon connection of a switch, the operation shall automatically change to manual on, automatic off (vacancy) mode for all loads.
5. Provide capability to convert each load independently to automatic on or vacancy mode using only the integral push buttons and LED indicators on the room controller.
6. When in vacancy mode, provide a 30 second grace period after an off during which automatic on shall be temporarily enabled.
7. It shall be possible to connect up to eight (8) room controllers together using Cat5 patch cables to provide configurations up to 16 switched and dimmed loads operating as a single zone.
8. Provide the following set up and configuration functions without the need for additional devices or software:

    a. Assign/reassign relays for control by wall switch station buttons
    b. Configure relays for occupancy or vacancy operation
    c. Assign/reassign dimmers to raise/lower switches
    d. Assign dimming channels for response to daylight sensor control
    e. Auto calibrate default daylight sensor sequence of operation
    f. Save preset scenes

2.3 Low Voltage Switch Stations

A. Low voltage digital wall switch stations shall be of the programmable type using plenum rated Cat5 cabling for connection to system smart port.

B. Stations shall have one to six buttons and provide lighting control functions as called out and shown on the plans.

C. All switches shall be single gang and be of the generic decorator style allowing easy ganging and use of a wide array of standard wall switch plate options.

D. Provide two RJ-45 ports per switch to allow for daisy chain connection of up to eight switches to each smart port.

E. Switch station color shall be white with white cover plates.

2.4 Occupancy / Vacancy Sensors

A. Occupancy sensors shall be ceiling or wall mounted and use dual technology (ultrasonic and passive infrared), ultrasonic and/or passive infrared (model specific) sensing technology as indicated.

B. Sensors shall be Class 2 and connect to any room controller smart port using a wiring adaptor and standard Cat5 patch cable.

C. Occupancy sensors shall be self adaptive and not require manual calibration after installation. Digital circuitry and logic shall automatically make adjustments to the sensitivity and time delay based on learned occupancy patterns and the environment in which the sensor is installed.

D. Sensors using both ultrasonic and passive infrared (dual technology) shall operate such that detection by both technologies is required to initiate occupancy and continued detection by either technology will maintain occupancy.

E. Up to four occupancy sensors may be connected to one room controller.

2.5 Emergency Lighting Interface

A. Where emergency lighting is to be controlled by the lighting control system, provide UL924 listed load control relays as necessary to insure that emergency lights are automatically turned full on upon loss of normal power to the area.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting controls as required and where indicated, in accordance with manufacturer's written instructions and project shop drawings, applicable requirements of NEC, and recognized industry practices to ensure that products serve intended function.

B. Sensor Design and Layout:

1. It shall be the equipment manufacturers'/ contractors' responsibility to provide the quantity of sensors required for complete and proper coverage without gaps within the range of coverage of controlled areas. Rooms shall have 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room. The locations and minimum quantities of sensors shown on the Drawings are diagrammatic and indicate only rooms which are to be provided with sensors. The equipment manufacturer/contractor shall provide additional sensors if required to properly and completely cover the respective room. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
2. Exact locations of control unit hardware boxes shall be based on observing good installation practice and shall be coordinated with other elements of the reflected ceiling plan. Control unit hardware shall be fully concealed.

C. Box Condition: Install low voltage lighting control devices only in electrical boxes which are clean, free from excess building material, debris, and similar matter.

D. Wiring:

1. All branch circuit wiring shall be installed in an approved raceway.
2. Low voltage wiring shall be installed in an approved raceway where concealed in inaccessible locations or exposed. Where low voltage wiring is concealed in accessible ceiling plenums, it may, with pre-approval from the Owner and Engineer, be routed without a raceway using air plenum rated cable.
3. All low voltage wiring shall be color coded and identified or tagged at terminals to assist with future maintenance.

E. Sensor Testing and Adjustment: At the time each sensor is installed, it shall be adjusted as follows:

1. Sensitivity shall be adjusted for proper occupant detection appropriate to the usage of the room.
2. Set time delay at approximately 6 minutes after setting in 30 second test to verify sensor/control unit operation.
3. Check indicator light of each sensor to verify that occupancy is being detected in the range desired.
4. Sensor operating frequencies shall be selected to select interference with other units in the vicinity as required.
5. Ensure that there are no obstructions which could block proper sensor coverage, thereby minimizing the sensor detection zone.
6. Occupancy sensors may be affected by various conditions in the room. It may be necessary for the Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room. The Contractor/equipment manufacturer shall have final responsibility for proper operation and coverage of the system in each room and should therefore make labor allowance for such changes and adjustments. The Contractor is also responsible for acquiring approval from Engineer for any changes or deviations from project specifications.

3.2 SPARES

A. Provide 10% spare sensors and switch packs of each type used on the project.

B. Deliver spares to the Owner at completion of project.

3.3 SYSTEM COMMISSIONING

A. The contractor shall provide lighting system functional testing per C408.3.1 of the 2015 International Energy Conservation Code. A lighting control system manufacturer’s representative shall be on site to assist the contractor during testing. Any deficiencies in the system’s performance shall be corrected immediately prior to issuing a final report.

B. All occupancy sensors shall be tested for location and functional acceptability.

C. Time switch controls shall be tested for the correct time, date and owners control schedule. Lighting on time switch controls shall be tested for on / off / dimming status.

D. Daylight responsive controls shall be tested for location and functional acceptability.

E. All building management system software, graphics, reporting and remote control shall be tested and accepted by the Owner prior to issuing the functional testing final report.

F. A final report certifying that the installed lighting controls meet documented performance criteria of section C405 of the 2015 International Energy Conservation Code shall be submitted to the Owner, Architect and Engineer for approval within 90 days from the date of receipt of the Certificate of Occupancy.

3.4 DEMONSTRATION/TRAINING

A. Upon completion of testing and adjustment, the Contractor shall demonstrate operation of the system to representatives of the Owner and Engineer.

B. The Contractors shall provide eight hours of instruction the Owner's personnel in proper maintenance, adjustment, and operation of the occupancy sensor lighting controls.

3.5 Project Closeout Documentation

A. Provide a factory published manual

1. Warranty
2. Technical support contact

3. Electronic manual

END OF SECTION

SECTION 26 51 07

EMERGENCY INVERTERS

PART 1 - GENERAL

1.1 REFERENCED DOCUMENTS

A. Comply with Division 1 - General Requirements and related documents.

B. Comply with all other Division 26 sections as applicable.

C. Refer to other Divisions for coordination of work with other portions of work.

1.2 DESCRIPTION

A. Work Included: Provide a standby, single or three-phase, solid-state, interruptible power supply for lighting and motor loads.

B. Related work specified in other Sections:

1. 26 00 00 Electrical
2. 26 05 19 Low Voltage Electrical Power Conductors and Cables
3. 26 95 32 Raceways
4. 26 05 33 Boxes for Electrical Systems
5. 26 51 01 Interior Lighting
6. 26 51 02 Exterior Lighting
7. 26 51 05 Networked Lighting Controls

1.3 QUALITY ASSURANCE

A. The equipment supplied and installed shall meet the requirements of the National Electrical Code and all applicable local codes and ordinances.

B. All equipment supplied shall be Underwriter’s Laboratories Inc. listed and so labeled.

1.4 REFERENCED STANDARDS

A. UL 924 Standard Emergency Lighting and Power Equipment

B. UL 924A Auxiliary Lighting

C. ANSI C62.41 (IEEE 587)

D. ANSI C62.42.45 (Cat. A & B)

E. National Electrical Code

F. NFPA- 101

G. OSHA and Life Safety Code

1.5 SUBMITTALS

A. Submittals shall include, but not be limited to, the following:

1. Voltage Ratings.
2. Overall Inverter Dimensions.
3. Interior Mounting Dimensions.

4. 1/4" scale layout of proposed equipment location including required working clearances, interference with other equipment and available recessing depth where applicable.
5. Location and arrangement of internal batteries.
6. Location and arrangement of internal transformer.
7. Number of poles, trip ratings, and interrupting ratings of circuit breakers.
8. Top and bottom conduit entries and knockouts.
9. Enclosure NEMA Type.
10. Enclosure deadfront, trim, door, hinge and locking provisions.
11. Manufacturer's literature describing circuit breakers and trip units for each type and frame employed.
12. System configuration with single-line diagrams.
13. Functional relationship of equipment including weights dimensions and heat dissipation.
14. Descriptions of equipment to be furnished, including deviations from these specifications.
15. Size and weight of units to be handled by installing contractor.
16. Detailed installation drawings including all terminal locations.

1.6 DELIVERY STORAGE AND HANDLING

A. Equipment shall be included and off loaded in accordance with the manufacturer's published instructions.

B. Upon arrival, inspect equipment for damage incurred in shipping.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

1.7 MANUFACTURER

A. The equipment shall be the product of a manufacturer with a minimum of ten years experience with the manufacture of similar equipment.

B. Acceptable Manufacturer

1. Inverter Systems, Inc.
2. Myers Emergency Power Systems

1.8 WARRANTY

A. Provide a two year parts and one year labor warranty. Warranty coverage shall begin at the time of Project Substantial Completion.

1.9 FACTORY TESTING

A. Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

PART 2 - PRODUCTS

2.1 ELECTRONICS MODULE

A. Nominal input/output Voltage: The Input and Output voltage of the inverter shall be pre-configured to match the user specified input and load requirements. Available voltages are 120, 208, 240, 277 or 480 Vac. Reference drawings for exact inverter input and output voltage(s).

B. Output Load Capacity: The output load capacity of the IPS shall be rated in kVA at unity power factor. The inverter shall be able to supply the rated kW from .5 lagging to .5 leading. Reference drawings for exact output load capacity.

2.2 BATTERY SYSTEM

A. Battery Cells: The inverter shall be provided with sealed, valve regulated front access lead acid batteries.

B. Reserve Time: The battery system shall be sized to provide the necessary reserve time to feed the inverter in case of a mains failure for 120 minutes (2 hours).

C. Recharge Time: The battery charger shall recharge the fully discharged batteries within a 24 hour period. The charger shall be an integrated three step with microprocessor controlled and temperature compensating.

2.3 TRANSFORMER MODULE

A. For systems with mixed input / output voltages the use of an isolation and / or autotransformer may be required. The input and/or output transformer(s) are not bypassed when optional maintenance bypass circuit is activated.

2.4 MODES OF OPERATION

A. The inverter shall be designed to operate with a 50-millisecond transfer time:

1. Normal: The inveter is an off line stand by system and the commercial AC power continuously supplies the critical load. The input converter (bi-directional transformer) derives power from the commercial AC power source and supplies to the inverter while simultaneously providing floating charge to the batteries.
2. Emergency: Upon a failure or brown out of the commercial AC power, the inverter, with a maximum of 50-millisecond break, switches its power supply from the input converter to the battery system. There shall be no more than a 50-millisecond loss of power to the critical load upon failure or restoration of the utility source. The system shall come standard with a normally off output (loads that are only powered during an emergency) capable of supporting full system load.
3. Recharge: Upon restoration of commercial AC power after a power outage, the input converter shall automatically restart and start charging the batteries. The critical loads are powered by the commercial AC power again.

2.5 AC INPUT

A. Voltage Configuration as shown on drawings.

B. Voltage Range: (+10%, -15%)

C. Frequency: 60 Hz (+/- 3%)

D. Power Factor: . 5 lagging / leading

E. Inrush Current: 1.25 times nominal input current, 10 times 1 line cycle for incandescent loads

F. Current Limit: 125% of nominal input current

G. Current Distortion: 10% maximum from 50% to full load

H. Surge Protection: Sustains input surges without damage per standards set in UL924.

I. AC OUTPUT

J. Voltage Configuration as shown on drawings.

K. Static Voltage Stability: Load current changes +/- 2%, battery discharge +/- 12.5%

L. Dynamic Voltage Stability: +/- 2% (25% step load), +/- 3% (50% step load)

M. Dynamic Recovery Time to within 1% of nominal: 3 cycles (0-100% load step)

N. Output Harmonic Distortion: < 3% THD (with linear load)

O. Frequency: 60 Hz (+/- .05Hz during emergency mode)

P. Load Power Factor Range: 0.5 lagging to 0.5 leading

Q. Output Power Rating: kVA = kW

R. Overload Capability:

1. to 100% continuous rating
2. to 115% for 10 minutes
3. to 150% for 16 line cycles

S. Crest Factor: <= 2.8

T. Efficiency 97- 98%

2.6 ENVIRONMENTAL CONDITIONS

A. The inverter shall be capable to operate within the specified design and performance criteria provided that the following environmental conditions are met:

1. Storage/Transport Temperature: 0 to 104 deg. F (-18 to 40 deg. C) with batteries, however, maximum recommended storage temperature for batteries is 77 deg. F for up to six months. Storage at up to 104 deg. F is acceptable for a maximum of three months.
2. Relative Humidity: 0 to 95% non-condensing:
3. Audible Noise: 45 dBA @ 1 meter from surface of the UPS During Emergency Mode.

2.7 FABRICATION

A. All materials shall be new, of current manufacture, high grade, free from all defects and shall not have been in prior service except as required during factory testing.

B. The inverter module and batteries shall be housed in a single freestanding NEMA type 1 enclosure. Front access only shall be required for installation, adjustments and expedient servicing (MTTR: < 15 minutes). All components shall have a modular design and quick disconnect means to facilitate field service.

C. The cabinet shall be powder painted with the manufacturer's standard color. The inverter shall be constructed of replaceable subassemblies. Like assemblies and like components shall be interchangeable.

D. Cooling of the inverter shall be forced-air in emergency mode with internally mounted fans to minimize audible noise. Fans shall not operate in the standby mode. Fan power shall be provided by the IPS. No air filters shall be required

2.8 COMPONENTS

A. Inverter Module - The inverter module shall contain an inverter, an AC distribution module with an input circuit breaker, back-feed relay, a transfer switch, control, and monitoring subsystems.

B. Battery Module - The battery module shall contain the battery plant required to produce the reserve energy to supply the inverter during abnormal AC mains conditions. The battery module shall be contained in same cabinet as electronics regardless of the system VA.

2.9 BATTERY CHARGER

A. General: In the standard configuration the charger converts ac voltage to dc voltage. With commercial power present, the inverter power transformer is powered and the IGBT modules are microprocessor controlled to recharge the batteries. The temperature compensated battery charger circuit supplies

constant voltage and constant current to the batteries. Once the batteries have received a full recharge, a constant trickle charge maintains batteries at maximum level. Recharge time is 24 hours maximum at nominal ac input voltage. The dc output's ripple current meets the battery manufacturer specification, thus ensuring the maximum battery lifetime.

B. AC Input Current: The charger unit is provided with an ac input current limiting circuit whereby the maximum input current shall not exceed 125% of the output full current rating.

C. Automatic Restart: Upon restoration of utility AC power, after a utility AC power outage and after a full IPS automatic end-of-discharge shutdown, the IPS will automatically restart, performing the normal

D. DC Filter: The charger shall have an output filter to minimize AC ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 2% RMS.

E. Battery Recharge: The charger is capable of producing battery-charging current sufficient enough to recharge the fully discharged battery bank within a 24-hour period. After the battery is recharged, the charger shall maintain full battery charge until the next emergency operation.

F. Over-voltage Protection: The charger is equipped with a DC over-voltage protection circuit so that if the DC voltage rises above the pre-set limit, the charger is to shut down automatically and initiates an alarm condition.

2.10 INVERTER

A. General: The inverter converts dc voltage supplied by the battery to ac voltage of a precisely stabilized amplitude and frequency that is suitable for powering most sophisticated electrical equipment. The inverter output voltage is generated by sinusoidal pulse width modulation (PWM). The use of a high carrier frequency for PWM and a dedicated ac filter circuit consisting of a transformer and capacitors, ensure a very low distortion of the output voltage (THD<3% on linear loads).

B. Overload Capability: The inverter during emergency modes shall be capable of supplying current and voltage for overloads exceeding 100% and up to 150% of full load current for 16 line cycles, 115% for 10 minutes.

C. Output Power Transformer: A dry type power transformer provides the inverter AC output. The transformer is built with copper wiring exclusively. The hottest winding temperature of the transformer shall not exceed the temperature limit of the transformer insulation class of material at ambient temperature.

2.11 DISPLAY AND CONTROLS

A. Monitoring and Control: The IPS system provides operation monitoring and control, audible alarms, and diagnostics. The front-mounted control panel includes a 4-line by 20-character vacuum fluorescent display and a keypad for user interface. The display will be menu driven. The system will have a continuous scrolling display of the following: Date & Time, System Status (AC Status, Battery Status, Charger Status) and any system faults: This allows the operator to easily "watch" system functions as they occur and check on virtually any aspect of the system's operation. Monitoring and control are microprocessor-based for accuracy and reliability. To ensure only authorized personnel can operate the unit, the system is multi-level password protected for all control functions and parameter changes.

B. Metering: Scrolling through the meter functions can monitor the following measurements:

1. Utility input voltage
2. System output voltage
3. Battery voltage
4. Battery current
5. System output current
6. System output VA

7. Inverter wattage
8. System temperature
9. Date & time

C. Audible Alarm: Audible alarm will activate with any of the following conditions and automatically store the 75 most recent events.

2.12 RS-232 INTERFACE

A. The system shall be equipped with an RS-232 serial port (DB9) for remote communications.

2.13 MANUAL AND PROGRAMMABLE TESTING

A. The system shall incorporate a manual test function and two automatic test modes. The system will perform a programmable, self-diagnostic monthly test for 5 minutes, and the user can program the event date and time of day. The yearly self-diagnostic test is for 90 minutes and the user can program the time of the day the event is to take place. The microprocessor automatically records the last 75 test events in its own separate test result log.

2.14 BATTERY ASSEMBLY

A. The batteries are front access sealed, lead-acid valve regulated battery cells with a one-year full, and nine year prorated warranty. Batteries shall be interconnected via buss bars and cables will be provided for shelf interconnects where required. A disconnect means shall be included for isolation of battery assembly from the IPS module.

2.15 OUTPUT CIRCUIT BREAKERS

A. Distribution circuit breakers are for output load protection. Protection for the normally on and/or the normally off loads. A maximum of 24 unsupervised 1-pole and a maximum of 15 supervised 1-pole circuit breakers are available.

2.16 OUTPUT CIRCUIT BREAKER TRIP ALARM

A. An audible and visual alarm activates when an output distribution circuit breaker is open or has tripped.

2.17 DIMMER BYPASS

A. Internal relays with individual overload protection circuit breakers that will allow individual dimmed circuits to be used as emergency circuits.

2.18 SUMMARY FORM “C” CONTACTS

A. Form “C” contacts rated at 5 amps maximum at 250VAC/30VDC. Dry contacts will change state when any system alarm activates. Contacts change states with the following alarms: High/low battery charger fault, near low battery, low battery, load reduction fault, output overload, high/low AC input volts, high ambient temperature, inverter fault, system test fault, and with optional circuit breaker trip alarm.

2.19 MAINTENANCE BYPASS SWITCH

A. This device is internally mounted in the system and permits maintenance personnel to easily bypass the protected equipment directly to the AC utility power. The make before break switch isolates the system to perform routine maintenance or servicing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring:

1. All branch circuit wiring shall be installed in an approved raceway.
2. Low voltage wiring shall be installed in an approved raceway where concealed in inaccessible locations or exposed. Where low voltage wiring is concealed in accessible ceiling plenums, it may, with pre-approval from the Owner and Engineer, be routed without a raceway using air plenum rated cable.
3. All low voltage wiring shall be color coded and identified or tagged at terminals to assist with future maintenance.

3.2 UNIT START-UP AND SITE TESTING

A. Site start-up and testing shall be provided by the manufacturer’s field service representative during normal working hours (Mon. - Fri. 8 a.m. - 5 p.m.). Site testing shall consist of a complete test of the inverter and accessories by the manufacturer in accordance with manufacturer’s standards. Manufacturer’s approved service representative must perform commissioning for two-year warranty to apply.

3.3 DEMONSTRATION/TRAINING

A. Upon completion of testing and adjustment, the Contractor shall demonstrate operation of the system to representatives of the Owner and Engineer.

B. The Contractor shall provide four hours of instruction the Owner's personnel in proper maintenance and operation of the system.

3.4 Project Closeout Documentation

A. Provide a factory published manual

1. Warranty
2. Technical support contact
3. Electronic manual

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. The intent of this specification is to ensure a successful installation of an American National Standards Institute (“ANSI”) and Telecommunications Industry Association (“TIA”) Standards-Based Structured Cabling System (“SCS”) throughout the Project.

B. The SCS is to be constructed and tested to ANSI/TIA-568-C Standards for Category 6 performance. Certification requirements will include a minimum 25 year product and performance warranty.

C. The SCS provides the physical media for the Project’s Local Area Network (LAN) and, as such, provides connectivity for:
   1. Data and telecommunication outlets.
   2. Facility Monitoring System network devices, e.g., surveillance cameras.
   3. Voice over Internet Protocol (VoIP).
   4. Wireless Local Area Network (WLAN).
   5. Building Automation System
   6. AV systems

D. The drawings and specifications requirements govern where they exceed Code and Regulation requirements.

E. Where local Codes or Regulations are more restrictive, they will take precedence over drawings and specs. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.

F. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

G. Coordinate exact location and installation of equipment, power, grounding and raceway requirements with the Architect.

H. Provisioning is required for labor, equipment, materials, supplies and plant.

I. Related Sections:
   1. The following list is intended only as a reference for the Contractor’s cognizance and may not represent a complete list of divisions of the Project Manual related to this section.
      a. Division 01: General Requirements.
      b. Division 08: Openings.
      c. Division 09: Finishes.
      d. Division 26: Electrical.
      e. Division 28: Electronic Safety and Security

J. The work of this section also includes:
   1. Required licenses, insurance and permits including payment of charges and fees.
   2. Verification of dimensions and conditions at the job site.
   3. Preparation of submittal information.
   4. Pick-up of Owner Furnished Equipment (OFE) and incorporation into project if applicable.
   5. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and the authority having jurisdiction (AHJ).
   6. Coordination of electrical service, including ground, for SCS/IT equipment locations.
   7. Final tests and adjustments, written report, and documentation.
   8. Instruction of system operation to Owner’s technical representative.
   9. Provision of manuals.

10. Maintenance services and warranty.

1.3. REFERENCES

A. Compliance with the following published codes, standards, and tests and recommended methods of trade, industry, or governmental organizations are required for Work in this section.
   1. Telecommunications Industry Association (TIA)
      a. ANSI/TIA-568-C (series),Telecommunications Cabling Standards.
      b. ANSI/TIA-569-D, Commercial Building Standard for Telecommunications Pathways and Spaces
      c. ANSI/TIA-606-B, Administration Standard for Commercial Telecommunications Infrastructure
      d. ANSI/TIA-607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
      e. ANSI/TIA-758-B, Customer-owned Outside Plant Telecommunications Infrastructure Standard
      f. TIA-526-7-A, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   2. Other
      a. BICSI Telecommunications Distribution Methods Manual (TDMM), 13th Edition
      b. BICSI Outside Plant Design Reference Manual, 5th Edition
      c. National Electric Code (NEC), 2017 Edition
      d. Underwriters Laboratory
      e. Americans with Disabilities Act (ADA)
      f. Requirements of the local Authority Having Jurisdiction (AHJ).
      g. Institute of Electrical and Electronics Engineers (IEEE), IEEE 1100 Emerald Book.
      h. City of Plano SCS Guidelines and Standards

1.4. DEFINITIONS

A. In addition to definitions of Division 1, the following list of terms used in this section are defined as follows.
   1. The “Consultant” referred to herein is the Owner’s Technical Representative for these systems.
   2. “Furnish” indicates to purchase, procure, acquire, and deliver complete with related accessories.
   3. “Install” indicates to set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, items, or equipment supplied by Contractor.
   4. “Provide” indicates to furnish and install.
   5. Some processes, methods, and procedures, as well as spaces, rooms and structure, may be abbreviated or used interchangeably within this section. The following list is presented to reconcile these differences within this section.
      a. Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.
      b. Telecommunications Space (TS) - A common area used for telecommunications cabling terminations and the location of telecommunications equipment.
      c. Equipment Room (ER) - An environmentally controlled space that is the primary point of interconnection between the communication facility provided by the public switched telephone company network and the building’s communications facility.
      d. Telecommunications Room (TR) – An environmentally controlled space that is the telecommunications structured cabling distribution point. The TR is designated for housing communications equipment and related wiring that serves a specific area of the building. Formally know as an IDF.
      e. Horizontal Distribution Cabling - The telecommunications cable, Category or fiber optic, routed between a TR, TE or the ER and a work area outlet.
      f. WAO: Work Area Outlet. The workstation end-point of horizontal distribution cable. An icon legend is provided on the related drawings, and symbols or legends represent the type and quantity of cables terminated at the WAO.
      g. TMGB: Telecommunications Main Grounding Busbar - The common source for bonding telecommunications equipment within the ER.
      h. TGB: Telecommunications Grounding Busbar - The common source for bonding telecommunications equipment within the EF, TR or TE.

1.5. SCOPE SUMMARY

A. This entire specification section and the project drawings define the requirements for the installation of a SCS. The following is intended to summarize the Work and clarify design intent and is not an exhaustive description of the SCS.

B. Coordinate exact location and installation of the following:
   1. Conduits, wire-ways, cable trays external to the telecommunication spaces, floor boxes, wall boxes, pull boxes, and junction boxes
   2. Slots and sleeves
   3. Firestopping products
   4. AC power circuits for telecommunications equipment
   5. AC power circuits within telecommunications spaces
   6. Plywood wall linings within telecommunications spaces
   7. Lighting requirements within telecommunications spaces
   8. MEP systems and equipment terminating within or intersecting telecommunications spaces
   9. Grounding electrode system and equipment grounding system required for telecommunications spaces
   10. Wireless access points data outlet with light fixtures, HVAC ductwork, and architectural elements
   11. Incoming service provider circuits

C. Deliver Submittals, Shop Drawings and Cable Test Records as specified herein.

D. Obtain permits, licenses, or other municipal requirements and pay any fees required for the execution of this Work.

E. Communications cabling shall comply with TIA 568 Standards.

F. Provide Category or fiber optic cabling for network communication applications homerun from the TR to individual work area outlets or network devices as shown on the related drawings.
   1. Provide faceplates, surface mount boxes, raceway products, copper and fiber optic inserts, blank inserts, patch panels, termination blocks, and copper and fiber optic patch cables.

G. Provide primary and branch pathway distribution systems which may consist of cable tray, conduit, J-hooks, of ladder runway for the support and protection of horizontal and backbone cabling.

H. Provide racks, cabinets, cable management, and cable runway to route cables and securely house telecommunications equipment and cabling termination panels.

I. Provide bonding of equipment racks, armored cable sheaths, and cable pathway system in accordance with equipment manufacturer’s requirements and Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

J. Provide labeling of the completed systems, components, and cabling in accordance with TIA-606-B or Owner’s standards. Verify labeling scheme with Owner prior to implementation.

K. Provide mechanical and non-mechanical firestopping systems as specified or required by code.

L. The Contractor must perform tests of the completed SCS installation to Category performance in accordance with ANSI/TIA-568-C.2, cited codes, standards, and procedures.

M. The Contractor must perform tests of the completed SCS installation of fiber optic cables in accordance with ANSI/TIA-568-C.3 cited codes, standards, and procedures.

N. Power Distribution Units (PDU) are Owner furnished and installed.

O. Battery backup/UPSs are Owner furnished and installed.

P. Wireless access points Owner furnished and contractor installed.

Q. Punch clock (bio-screen) are Owner furnished and installed.

R. Supply accessories and minor equipment parts regularly required for a complete system, even if not specifically mentioned in these Specifications or on the drawings, without claim for additional payment.

S. Perform installation and testing utilizing trained and certified staff in order to provide the Owner’s vendor of choice SCS extended product and application warranty certification (25 years). The Contractor shall extend this certification on behalf of the manufacturer.

T. Provide instructions to the Owner's designated personnel on the system documentation, proper methods of use and maintenance of the system and related components.

U. Project shall install the SCS passive equipment in a existing TR as shown on the drawings. Coordinate with Owner the installation of the equipment in existing equipment racks.

V. Provide the SCS complete and ready for use by the Owner.

W. Cables damaged during the installation of new cables through existing pathways are to be replaced with like and kind cables at no additional cost to the Owner.

1.6. QUALIFICATIONS

A. The Contractor shall be a Certified Integrator/Installer factory trained and authorized to provide a 25-year CommScope Network Infrastructure System Extended Product and Application System Warranty covering all network cable and connectivity hardware products comprising this installation site.

B. The Contractor shall submit current manufacturer certification documentation for installation training and ability to provide the manufacturer warranty. The Contractor must maintain a factory trained and certified staff covering the duration of the project.

C. The Contractor must have an on staff Registered Communications Distribution Designer (RCDD®) for the performance of quality control during installation, equipment set-up. and testing.

D. The Contractor shall have previous experience with Birdville ISD on projects of similar size and scope and be approved by BISD Technology.

E. Any sub-Contractor, who will assist the SCS contractor in performance of this work, shall be certified by the manufacturer and be approved by Birdville ISD.

F. Birdville ISD Technology shall be consulted and review and approve sub-contractors prior to issuing contracts.

G. The Contractor must have ten plus (10+) years of experience with equipment and systems of the specified types.

H. The Contractor must have completed a minimum of three comparable scaled projects within the last two years.

I. The Contractor must have proven abilities to test and certify telecommunications cabling systems, and to create test records in compliance with the referenced standards of this specification section.

J. The Contractor must maintain a fully staffed and equipped service facility.

K. The Contractor must perform operations necessary to complete the installation of a SCS in accordance with these specifications utilizing related drawings.

L. At the request of the Architect, the Contractor must demonstrate an adequate staff with commensurate technical experience available.

M. At the request of the Architect, the Contractor must demonstrate adequate plant and equipment available to complete the work.

1.7. PRECONSTRUCTION SUBMITTALS

A. The pre-construction submittal is required to verify the CONTRACTOR will obtain the specified product, understands the processes and procedures, and understands the requirements to install, test, certify and create test record documentation for the SCS.

B. All requests for substitutions of specified product must be done using procedures specified in Division 1. Requests must be done prior to submittals. Substitutions submitted that have not been approved will be rejected.

C. The Submittal package is to be delivered for approval prior to commencement of Work.
   1. Any submittals beyond the original submittal and one resubmittal may result in charges to the CONTRACTOR (charged for third and any subsequent reviews).

D. Additional review fees will be at the prevailing rate in effect at the time that the additional review takes place

E. The Submittal for this portion of the Work must be assembled and packaged as specified.

F. Provide 4 copies of submittals within 14 days of Notice to Proceed.

G. Provide submittals in an electronic version in Adobe PDF format as follows:
   1. Document set shall be in a folder named as follows:
      a. "SUBMITTAL – Birdville ISD Smithfield MS Gym – 271000 – {*CONTRACTOR name*}".
   2. With the following subfolders
      a. "Project Compliance
      b. "Certificates"
      c. "Test Equipment"
      d. "Materials"
      e. "Labels & Markings"
      f. "Shop Drawings"

H. "Project Compliance" folder shall contain a PDF document that includes:
   1. The first page stating the project title, submittal number, and submittal date in the header. This cover sheet must be imprinted with Contractor's stamp, initialed or signed, certifying that the Submittal Package offered is in compliance with the requirements of this Section, and the material is in compliance with this Section of the Project Manual or with approved substitutions.
   2. The next page shall state any questions or concerns the might be relevant to clarifying the work
   3. Provide a list of 'Approved' substitutions, if any.

I. "Certificates" folder shall contain a PDF document that includes:
   1. Current manufacturer Certification that shows that the Warranty requirement of this Section can be provided by the CONTRACTOR.
   2. RCDD certificate and any other BICSI certifications called out as a requirement in this Section

J. "Test Equipment" folder shall contain a PDF document that includes
   1. Furnish a technical description of the test equipment that will be utilized for test and certification of the specified cables, include the Manufacturer, make and model.
   2. Include the date of the most recent calibration and company name that performed calibration.
   3. Submit an example of a test record document containing test records that have been created with the scheduled test equipment for the type of cabling to be tested.

K. "Materials" folder shall contain a PDF document that includes
   1. A complete materials list or Bill of Materials that includes all products specified in this Section or previously approved through the substitution request process in Division 1.
      a. Present the materials list or Bill of Materials in the order in which the product is specified in Part 2 of this section.
      b. The column headings for the list must include a product description, manufacturer, part number, quantity of item required, use or location on project, and PDF page number of product data sheet in this document.
   2. All product data sheets shall be combined into (1) PDF document. The PDF page number is the actual number of pages into the document where the product sheet can be found.

   3. Example

Description	Manufacturer	PN	Use	Page
Blue Category 6 connector	CommScope Systimax	##	Data outlet	15

      a. Immediately following the list, insert the manufacturers' product data sheet (PDS).
      b. Arrange the sheets in the same sequence and order of the list of Materials.
      c. The literature must provide sufficient detail to facilitate proper evaluation of the product's suitability for use within the Work.
      d. Any PDS or literature sheets that provide for product options, or sheets that also include items not intended for this work, must be clearly marked with an arrow or other appropriate symbol to indicate the model and/or option being submitted for the work.

L. “Labels & Markings” folder shall contain a PDF document that includes Sample
   1. Submit photos or drawings of the proposed labels, tags and markers for all cables, patch panels, termination blocks, busbars, fire sleeves, enclosures, racks, outlet faceplates and other components as necessary.
   2. Submit representative nomenclature for equipment and cable labeling, with labeling as defined in ANSI/TIA-606-B Class 2 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings. Include font sizes and styles, an explanation of the rationale for the nomenclature, and a Key, which defines the descriptors and designators of the labeling system.
   3. All labels to be permanent and non-destructible.
   4. Product sheets for label materials shall be included in the “Materials” folder

M. “Shop Drawings” shall contain PDF documents including:
   1. Submit shop drawings for owner review and approval within 28 days of notice to proceed.
   2. Owner must sign off shop drawings before any cabling can proceed.
   3. Submit a letter of Drawing Compliance stating the Contractor complies with the entire project drawings, including all notes; general and keyed. If the Contractor deviates from any portion of the drawings a detailed explanation shall be included in the letter of Drawing Compliance.
   4. Drawings that are required to clarify or demonstrate and understanding of the requirement of this work. If not already defined:
      a. Dimensioned plan-view drawings of individual Equipment Rooms depicting rack types, locations, and dimensions.
      b. Dimensioned rack elevations depicting equipment-mounting space in racks, rack-attached wire managers, routing, and rack identifiers.
      c. Wall elevations of all Equipment Rooms defining locations of all equipment mounted thereon.
      d. Any special installation details or unique means and methods necessary to successfully complete the cabling infrastructure installation.
   5. A list of all submitted drawings, including a listing of separate, large-size drawings.
      a. Large-sheet drawings;
         1) Drawing rendered in AutoCAD™ or an AutoCAD™-compatible application.
         2) Execute drawings at an appropriate scale but no less than 1/8”=1’-0”.
         3) Create drawings using industry-standard graphics and a monochromatic scheme with varied line types and weight so the attributes of the various elements of the image are readily discernable when printed in black and white.
         4) Enlarged floor plans and elevations of all equipment rooms with equipment and ladder runway(s) placement in the rooms shall be shown to scale.
         5) The Shop Drawings will be the source document for the As-Built drawings that the CONTRACTOR is required to provide at the close of the project.
   6. Floor plan sheets that depict;
      a. Individual service areas of the facility.
      b. Equipment room locations.
      c. Work area faceplate/outlets locations.
      d. Raceway locations.
      e. Horizontal cable link length for longest cable lengths based on above routing.
      f. Location and size of all wall penetrations/sleeve pass-thru.
      g. Quantity of cables passing through each wall penetration/sleeve pass-thru.

1.8. CONTRACT CLOSE-OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements.

B. Two copies shall be delivered to the building owner’s representative at the time of system acceptance.

C. Each submittal shall be provided in a PDF format.

D. Provide each submittal PDF file with the project title and submittal number.
   1. Transfer media, CD, or memory stick, shall be labeled with same information.

E. Segregate documents into separate folders containing data relevant to operational, maintenance, and warranty issues.

F. Warranty and Maintenance:

1. Statement of warranty commencement date, length of warranty, and all warranty certificates issued by manufacturer.
2. Provide a list of contact names, telephone numbers, and hours of operation for normal warranty service.
3. Provide a contact name/number for 365/7/24 emergency warranty service with an explanation of limiting conditions if applicable.
4. Include maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
5. Manufacturer data sheets and installation manuals/instructions for all equipment installed shall be included.

G. Test Report CD(s)
1. Results of copper and fiber-optic tests specified in Part 3 of this section of the Project Manual.
   a. The test records are to be a full test report of individual copper media and fiber optical media test results for each fiber-optic cable strand.
   b. The test record must include information regarding the building, closet, patch panel and “port” number of the patch panel; the test device type and ID, the name of the test technician performing the test, and the date and time that the test was conducted.
2. The test records are to be placed in a “Test Record” file in ascending sequential order by building, closet and patch panel.
3. Provide an electronic file containing all individual test records and the software required to display and print the test records using a typical personal computer (PC).

H. Record Drawings
1. Provide “as-built” drawings of the completed cabling installation.
2. The as-built drawings must indicate:
   a. The actual locations of the work area faceplate/outlets
   b. Pathways and pathway fill
   c. Media identification information at each faceplate/outlet
   d. The identity information for each Equipment Room
   e. Revised equipment rack layout detail drawings
   f. All field changes, corrections, modifications, and updates to the shop drawings
3. One (1) color/laminated full-size drawing must be attached to the wall of each TR to include the aforementioned information. Only the drop locations served from each particular TR are to be included on each color/laminated drawing for that TR.
4. Provide owner copies of “as-built” drawings on CD media in AutoCAD, Revit and PDF format.

I. Provide Owner any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.

J. Furnish a list (in excel format) of all data drops listed by TR number, patch panel number, and port number with the associated District assigned room number.

1.9. DELIVERY, STORAGE, AND HANDLING

A. Ship product in its original container, to prevent damage or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer’s recommendation.

C. Provide protective covering during construction, to prevent damage or entrance of foreign matter.

D. Provide warning placards, warning tape or protective barrier systems for temporary protection of products or personnel during installation processes to include but not limited to the following:
1. Cabling subject to foot or vehicle traffic laid on the floor/ground as a service loop.
2. Exothermic welding of telecommunications bonding conductors.
3. Open trench work during cabling installation.

E. Provide a minimum temperature schedule for cold climate installations of the SCS. Do not install cabling or equipment in climate conditions less than the manufacturers recommended minimum temperature.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.10. PROJECT CONDITIONS

A. Verify dimensions and conditions on the job site applicable to this work. Notify the Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

C. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. When a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

D. During the course of construction, room names and/or room numbers may be changed. For continuity during installation the Contractor shall refer to rooms and spaces by their identities as shown on the technology series drawings. This shall apply to all correspondence, RFI's, proposal requests, and submittal packages pertaining to this Section.

E. Provide temporary or permanent protection of materials bearing the UL label that risk exposure to conditions that may compromise any portion of the material.

F. Coordinate the SCS work with the General Contractor and related work of other contractors to include but not limited to the following.
   1. Conduits, wire-ways, cable trays external to the telecommunication rooms, floor boxes, wall boxes, pull boxes, junction boxes and AC power circuits for the SCS.

1.11. PRODUCT WARRANTY AND APPLICATION ASSURANCE

A. The SCS Manufacturer's Extended Product Warranty and Application Assurance requirements are as follows:
   1. Extended Product Warranty
   2. Application Assurance
   3. Term of Warranty
      a. 25 years from the date of substantial completion.
      b. Moves, additions, or changes are covered by the original registration certificate if performed by an approved installer in compliance with the supplier's SCS design, installation and registration requirements.

B. Contractor's warranty covering all installed products and labor against defects in materials and workmanship for a period of 1 year.
   1. Within the 1-year warranty period, answer service calls within 4 hours and begin work to correct the deficiency within twenty-four hours.

C. Manufacturer Warranty starts the date of projects warranty certification issue to the District from the manufacturer.

D. A manufacturer's Representative shall inspect and certify all work to validate the manufacturer's warranty.

PART 2 - PRODUCTS

2.1. GENERAL

A. Related Divisions and articles remain applicable to the products specified herein. Any repetition of related specification is for emphasis only.

B. Products shall be new, free from defects and listed by UL or ETL when an applicable standard exists. Provide product of a given type from one manufacturer.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers published specifications.

D. Any materials required in the completion of the cabling infrastructure and make-ready for use by the Owner that is not listed is the responsibility of the Contractor.

E. Product not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified product and equipment.

F. Products included in this Section are to establish performance requirements to be used on this project; equivalent products are acceptable with Owner approval.

G. 1000 ft spool of category cabling must have test results from manufacturer attached to the spool.

2.2. CABLE PATHWAYS AND SUPPORT

A. Horizontal wire managers, 3U
   1. Black in color
   2. Single sided, dual hinged cover
   3. Approved products
      a. Chatsworth Part # 13930-703

B. 12” cable runway
   1. 10’ length (9’-11 ½”)
   2. 3/8” x 1 ½” steel tubing
   3. 12” cross member intervals
   4. Mounting hardware and brackets
   5. UL Classified
   6. Black in color
   7. Approved products
      a. Chatsworth Part # 10250-712

C. 12” cable runway stringer radius drop
   1. UL classified
   2. Black in color
   3. Approved products
      a. Chatsworth Part # 14305-712

D. 12” cable runway radius drop
   1. UL classified
   2. Black in color
   3. Approved products
      a. Chatsworth Part # 14304-704

E. J-hooks
   1. Made for support of Category 6 cables
   2. Provide with retaining clip for J-hooks sized 1 5/16” and larger
   3. Provide with required building attachment method
   4. Approved products
      a. Erico CADDY CAT series
      b. Panduit J-Mod series
      c. CEAS 200 – 224 series
      d. Cooper B-Line BCH series
      e. Approved equal

F. Nonmechanical firestop systems
   1. UL classified
   2. Intumescent flexible block
   3. Intumescent non-hardening putty
   4. Intumescent pillows

2.3. COMMUNICATIONS HORIZONTAL UTP CABLING

A. 4 pair Category 6 UTP CMP communications cable
   1. Blue jacket
   2. Only complete 1000 ft spools accepted. “Shorts” will not be allowed and if discovered, the SCS Contractor will be required to remove all cable and reinstall at no additional cost to the Owner.
   3. Approved product
      a. CommScope Systimax Part # 2071E Plenum GigaSPEED XL 2071E ETL

B. 4 pair Category 6 OSP communications cable
   1. Black jacket
   2. Only complete 1000 ft spools accepted. “Shorts” will not be allowed and if discovered, the SCS Contractor will be required to remove all cable and reinstall at no additional cost to the Owner.
   3. Approved products
      a. CommScope Systimax Part # 1571A GigaSPEED XL 1571

C. Category 6 RJ-45 connector
   1. 8-position, 8-wire RJ45 receptacle
   2. Blue in color
   3. Approved products
      a. CommScope Systimax Part # MGS400-318

D. RJ45 jack dust cover
   1. White in color
   2. Approved products
      a. CommScope Systimax Part # M20AP-262

E. Flush mount workstation faceplates
   1. White in color
   2. Approved products
      a. CommScope Systimax
         1) 1 port Part # M10LE-262
         2) 2 port Part # M12LE-262
         3) 4 port Part # M14LE-262
         4) Provide blank insert match faceplate color

F. Industrial Faceplate, 1-port
   1. Gymnasium floor outlet locations
   2. Compatible with specified RJ45 connector
   3. Provided with tethered cap
   4. Acceptable product
      a. CommScope Systimax MIR-RJ45

G. Surface mount workstation
   1. White in color
   2. Approved products
      a. CommScope Systimax
         1) 1 port Part # M101SMB-262

H. Category 6 patch panel
   1. 48 port patch panel
   2. Cool gray color
   3. Unshielded
   4. Approved products
      a. CommScope Systimax
         1) 48 port Part # 360-PM-GS3-2U-48 (760117366)

I. Category 6 patch cords - TR
   1. Approved products
      a. CommScope Systimax
         1) Gray jacket Part # CPC3312-03Fxxx
         2) Replace x with length in feet.
   2. Provide quantities of:
      a. 25% of the installed ports, 3 foot
      b. 50% of the installed ports, 5 foot
      c. 25% of the installed ports, 7 foot
      d. 50% of the installed ports, 10 foot
   3. Confirm color, length and quantity with Owner prior to purchasing

J. Category 6 patch cords - Workstation
   1. Approved products
      a. CommScope Systimax

1) Gray jacket Part # CPC3312-03Fxxx
2) Replace x with length in feet.

2. Provide 100% of the installed ports, 10 foot
3. Confirm color, length and quantity with Owner prior to purchasing

K. Copper Test Cords, Category 6
1. 15 feet in length
2. Category 6 stranded UTP
3. Red in color
4. Provide two test cords for each group of 100 horizontal cables installed. (ex. 320 installed cables will require eight test cords.)
5. Discard test cords after 100 cables tested

A. 100-pair 110 Wiring Block, CAT 6, with legs
1. Equipped with 5-pair connecting clips, designation strips and clear holders
2. Acceptable product
a. CommScope 110DW2-300

PART 3 - EXECUTION AND SCOPE

3.1. GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. The installation recommendations contained within TIA-568-C, TIA-569-D, and the BICSI Telecommunications Distribution Methods Manual (TDMM), including manufacturer recommended installation methods or practices for a standards-based SCS, are mandatory minimum standards and requirements.

C. Mount equipment plumb and level. Permanently installed equipment to be firmly and safely held in place. Equipment supports must support loads imposed with a safety factor of at least five.

D. Each outlet must consist of an outlet box and plate listed on the legend provided on drawings.

E. Coordinate with Architectural and Electrical drawings for locations of telecommunication outlets, junction boxes, conduits and floor boxes within the project.

F. Route cables from outlets to the nearest TR unless the drawings designate cables to be routed to specific TR locations. Notify the Owner’s representative if any cables are expected to exceed 285’-0” in length from device outlet to patch panel.

G. Provide temporary or permanent protection of materials bearing the UL label that risk exposure to conditions that may compromise any portion of the material.
1. Do not paint or allow paint overspray on products bearing a UL label unless specifically approved by the manufacturer.

3.2. CABLE PATHWAYS AND SUPPORT

A. Conduit
1. Install raceway and conduit system complete with offsets, pull boxes, junction boxes and fittings.
2. No raceway shall be run horizontally inside of walls or partitions. Exceptions: building perimeter walls under windows, clerestory panel walls, and where structural conditions do not allow vertical access to tops of walls.
3. Install rigid wall hot-dipped galvanized steel conduit in the following locations:
a. Where exposed to physical damage
b. Outdoors
c. Indoors where exposed to moisture
d. Where required by code
4. Install Electrical Metallic Tubing (EMT) – minimum size 1-inch in the following locations:
a. Interior spaces not subject to moisture
b. Where openly run communications cabling passes through inaccessible ceilings.
c. As shown on drawings
5. PVC Conduit:

a. Utilize PVC conduit for underground installations, minimum size 4-inch.
   1) PVC conduit runs shall have PVC coated rigid steel stub outs from the ground, including the last 90 degree bend.
   2) Elbows for conduit installed below grade shall be rigid steel conduit with two coats of corrosion-resistant paint or tape wrap.

6. Multiple Conduit Installation:
   a. Install conduits parallel to or at 90 degrees to the structure. Multiple conduits shall not be installed using a single rod support. Multiple conduits running the same direction with spacing 48 inches apart or less shall be installed on the same trapeze.
   b. Trapeze hangers shall be supported on minimum 3/8-inch diameter all-thread rod attached to the structure with coupling nuts and expansion bolts or beam clamps.
   c. Conduit straps or other devices specifically designed for the purpose shall be used to secure conduits to the metal framing. Wire ties and hanger wires are not permitted.
   d. Conduits shall only be installed on the top surface of the metal framing, with multiple layered trapeze supports if required.
   e. Hanger rods shall not extend more than 1 inch past the lower trapeze metal framing. Use double nuts for all-thread rods.
7. Single Conduit Installation:
   a. Install single conduits parallel to or at 90 degrees to the structure and suspended from the structure on all thread rods (1/4-inch minimum) or clamped and/or clipped to the structure with manufactured clamps/clips.
   b. When single conduits are suspended from all thread rods, conduit clamps with bolts and nuts shall be used.
      1) Through partition wall penetration shall not be construed as a means of conduit support.
      2) Wire ties and hanger wires are not permitted.
   c. Single conduits may be secured as follows:
      1) Toggle bolts on hollow masonry.
      2) Bolts and expansion anchors in concrete or brick.
      3) Machine screws, threaded rods and clamps on steel.
      4) Conduit clips on steel joists.
      5) Plastic anchors are not allowed.
8. Install expansion fittings in metal conduit as follows:
   a. Conduit Crossing Building Expansion Joints:
      1) EMT all sizes.
      2) Rigid Galvanized Steel (RGS) all sizes.
   b. Conduits entering environmental rooms and other locations subject to thermal expansion and as required by NEC.
   c. Provide conduit expansion fitting with an integral bonding braid.
   d. Expansion fittings are not required where offsets, expansion loops, or flexible conduit are placed in conduit runs.
9. Install conduit concealed in walls, partitions and above ceilings.
10. Install exposed overhead conduit (at structure) of mechanical rooms and in other similar rooms where ceilings are not provided.
11. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
12. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
13. Provide fabric innerduct with polyester flat woven pull tape as specified and shown in drawings following manufacture guidelines.
14. Install pull wires in empty conduits. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
15. Do not daisy chain conduit installations in or on walls, provide a single conduit wall drop per device.
16. Communications pathways exposed to public view shall be in conduit, stubbed to cable tray or accessible ceiling.
17. All exterior junction boxes, conduit/raceway, terminations, etc. at and those within enclosures where enclosures are exposed to outdoor conditions are to meet NEMA ratings for outdoor electrical applications. Maintain an 8 inch minimum clearance between the bottom of the cable Support all cables not installed in conduit or cable tray with J-hooks sized for the quantity of cable installed plus 20%.

B. Workstation outlets
   1. Install backboxes with reducer rings as called out on the drawings
   2. Each outlet must have a dedicated conduit extending 18 inches into an accessible ceiling, to cable tray or into a TR.
      a. Daisy chaining of outlets is not allowed unless otherwise noted o the drawings.
      b. All conduits must be equipped with bushings and a 200lb test pull line.
   3. Coordinate with Architectural and Electrical drawings for locations of telecommunication outlets, junction boxes, conduits and floor boxes within the project.

C. Cable Tray
   1. Cable tray must not be installed above hard ceiling such as sheetrock unless access is provided at intervals not exceeding 8 feet.
   2. In a dropped ceiling environment, a minimum of 9-inch clearance shall be observed between the cable tray, including supports, and the false ceiling.
   3. In all environments, a minimum of 12-inch clearance shall be provided above cable tray and 12-inch clearance shall be provided at one side of the cable tray.
   4. Cable tray support system must consist of trapeze style or tray manufacturer provided wall brackets.
      a. Center hung support systems are not allowed.
      b. Cable tray installed on walls must utilize manufacturer provided wall supports that space the tray off the wall.
   5. Cable tray must be attached to the building structure using a minimum 3/8” all-thread connected to anchors or fittings designed for the purpose.
      a. All-thread shall not extend more than 1 inch past the lower trapeze metal framing. Use double nuts for all-thread rods.
   6. Use manufactures fittings for splice, bends and junctions.
   7. Support cable tray at intervals recommended by the manufacturer.
   8. Tray is to be 12” x 4” or larger to not exceed 60% of the usable space on day one.
   9. All junctions, splices, transitions are to be installed using manufactures recommended guidelines.
   10. Cable tray installers must have successfully completed Manufacturers Certified Installer program.
   11. Cables shall be segregated in the tray by cable color and use.

D. J-Hooks
   1. Support all cables not installed in conduit or cable tray with J-hooks.
   2. Maximum of 48 cables per bundle (multiple bundles cannot share j-hook).
   3. Wherever practical install all cable running square with building structure.
   4. Route cable bundles down hallways or other accessible routes.
   5. Space J-hooks at no greater than 5 foot intervals unless a lesser interval will be required for product warranty.
   6. Straps must be suitable for use in air handling spaces, both removable and unusable.
   7. Provide J-hooks with the proper configuration to attach to the building structure at each location.
      a. Where direct attachment to the building is not practical use of hanger wire or threaded rod attached to the building and dedicated to cable support is acceptable
      b. Do not attach J-hooks to any support used by other trades.
   8. J-Hook shall have electro-galvanized or G60 finish and be rated for indoor use in non-corrosive conditions.
   9. Stainless steel J-Hook supports are use in both indoors and outdoors in non-corrosive environments o r in mildly corrosive conditions.
   10. No support may be secured to the drop ceiling grid support wire. Cabling found connected in this manner will replace the assembly at the expense of the contractor.

3.3. COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. For each new 48 port patch panel required provide 1 Horizontal Manager to the Owner for Owner provided switch installation.

B. Provide additional overhead cable runway to support new horizontal link cabling entering the existing IDF as required and in other spaces as shown on drawings.
   1. Provide wall angle brackets and attach the ends of the ladder runway to walls.
   2. Where possible, provide and attach the ladder runway to equipment cabinets with cabinet to runway mounting plates and elevation kits.
   3. Bond UL classified cable runway systems following manufacturer guidelines to TMGB/TGB busbar.

4. Provide support for the ladder runway every 5 feet.
   a. Support runway with triangle wall brackets
   b. Support runway from above with support brackets and 3/8” threaded rod attached to building structure.
      1) Attach threaded rod to building structure using concrete anchors, beam clamps, or other devices designed for building attachment. Connections must have a pull-out strength and be spaced to provide support for the ladder runway to meet the manufacturer’s load rating for the ladder runway.
      2) Provide plastic threaded rod covers to cover lower 2 feet of threaded rod.
5. Provide any seismic bracing required by local codes for free-standing racks designed and sealed by a registered professional engineer licensed to practice in the state.
6. Field cuts must be filed smooth, dressed square, and painted to match.
7. Provide end caps on all exposed ladder runway ends.
8. Provide and connect all ladder runway with appropriate butt splice kits, junction splice kits and other hardware designed for assembly of the runway system.
9. Provide cable radius drop out from ladder runway to vertical cable managers at every location where cables transition from the runway to the cable managers.
   a. Use moveable cross members where required to mount the cable radius drop so cables can directly into the vertical cable managers.

C. Provide vertical wall mount ladder runway as required to support vertical cable pathways transitions over 4’-0”.
   1. Attach to wall using vertical wall brackets.
   2. Provide end caps for top end of vertical runway.

3.4. COMMUNICATIONS HORIZONTAL UTP CABLING

A. Provide Category 6 UTP cables homerun from workstation outlets shown on the drawings to the nearest telecommunications room unless noted otherwise.
   1. Install in compliance with manufacturers installation procedures.
   2. Confirm all conduit openings have busing prior to installation.
   3. Confirm all firewall penetrations have sleeves installed prior to installation.
   4. Confirm acoustically rated wall penetrations have sleeves or openings that will allow for the acoustic rating to be restored after cable installation.
   5. Confirm pathways have adequate capacity to support the cable type and quantity.
   6. Replace, at no additional cost to the Owner, cable that has been crushed, deformed, skinned, crimped, or twisted.
   7. Do not install cable in climate condition less than the manufacturer’s recommended minimum temperature.
   8. Only install cable in areas it was rated for:
      a. Do not install outside plant cables (OSP) more than 50 feet inside buildings unless inside of continuous metallic conduit
      b. Do not install riser rated cables (CMR) in plenum air spaces
      c. Do not install plenum rated cables (CMP) or riser rated cables (CMR) in outside plant environments, including conduits below/in slab that maybe exposed to moisture, unless they have a dual rating for outside plant.
   9. Do not install cables with a total length greater than 285 feet without written permission from the Owner’s representative. The length of jumper cables or patch cords in the TS shall not exceed 5 meters (15 feet).
   10. Install cable so that the pulling tension applied to the cable does not exceed 25 lbf or the manufacturer’s guidelines whichever is lesser.
   11. Install cable so that a radius bend of no less than six times the cables outside diameter is maintained during and after installation.
   12. Maintain a 6 inch minimum clearance above accessible ceiling tiles.
   13. Maintain the following distances from sources of electrical interference:
      a. 6 inches from fluorescent lighting
      b. 6 inches from electrical power distribution conduit
      c. 12 inches from unshielded electrical power cables
      d. 48 inches from electric motors and transformers.
   14. Communication cables must not be run loose or lay upon ceiling grid or ceiling tiles.

15. Communications cable shall not be fastened to or supported by electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to doors, utility access panels, or service work areas.
16. Cover edges of cable/wire pass-through holes in chassis, housings, boxes, etc., with insulated grommets.
17. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation.
18. Provide a 10 foot service loop at each workstation above accessible ceiling.
19. Label cables within 4 inches of termination with the specified labeling scheme.
20. Dress cables neatly where exposed in the telecommunication room.
21. Secure cable bundles with plenum rated hook and loop tie wraps. Use of nylon tie wraps is unacceptable.
22. No cable ties, bridle rings, or D-rings shall be accepted on the project. Any use of cable ties may require replacement of the entire project cabling at the Contractor's expense.

B. Provide Category 6 RJ-45 jacks in the colors called out in this Section and on the drawings.
   1. Terminate cables on jacks with a T568B pinout for new building construction:
      a. Match existing pinout for facilities undergoing remodel or expansion
      b. Strip cable jackets and untwist pairs only as much as is required to terminate individual pairs
      c. Match cable colors to jack colors called out for specific applications
      d. Install jacks at workstations in configurations shown on the drawings.

C. Provide workstation outlet types in locations shown on the drawings

D. Provide Category 6 patch panels to support workstation cables.
   1. Terminate cables on patch panels grouped by applications as shown on the drawings.
      a. Match existing pinout for facilities undergoing remodel or expansion.
      b. Strip cable jackets and untwist pairs only as much as is required to terminate individual pairs, following manufacturers installation procedure.
   2. Terminate cables on patch panels as a 568B pinout.
   3. Coordinate placement of new patch panels in existing IDF rack with Owner IT.

E. Furnish Category 6 patch cords in colors, lengths, and quantities as specified.
   1. Confirm with Owner prior to purchasing.

3.5. LABELING

A. Provide labeling in accordance with ANSI/TIA 606-B Level 1 and as shown on the drawings.

B. Mechanically print and install in accordance with drawing details.

C. Labels must be single line all capital letters bold font. Select font size that can be read on the applicable device or cable.

D. Ensure all surfaces are clean prior to placing labeling products. Follow manufacturer's recommendation for cleaning.

E. Both ends of telecommunications cables, outlet faceplates, terminal blocks, floor boxes, termination cabinets, patch panels, ground busbars, ground cables, equipment racks, and equipment rooms must be labeled in accordance with the aforementioned standards.

F. Hand written labels are unacceptable.

G. Locate the cable designator at the origination and destination of each cable within 4 inches of the point of termination or connection.

H. Provide machine printed wall plate labels meeting ANSI/TIA 606-B standards inserted behind built-in clear plastic windows.

3.6. TEST AND CERTIFICATION

A. Pretest notification
   1. Prior to conducting any field-testing of the SCS the Contractor must deliver to the project ARCHITECT a written notification of the test commencement date and the sequence of testing.
   2. If the Contractor elects to commence testing in a phased approach, prior to completion of cable installation, a test sequence schedule must be provided.

3. Notification must be delivered to the Architect at least three weeks prior to the scheduled test date.
4. Upon receipt of the notification the Architect will arrange within 72 hours for the Owner's technical representative to attend the commencement of testing.
5. The purpose of the Owner's technical representative's attendance will be to observe:
   a. The type of test equipment being utilized compared to the scheduled test equipment.
   b. The test equipment can perform the tests to comply with the specified Standards.
   c. The Contractor's technical personnel are prepared to conduct the tests.
   d. The Owner's technical representative will make an Observation Report to the Architect
6. Failure to offer notification as specified above will subject the Contractor to re-test any cabling that was tested prior to the Owner's technical representative review, at no additional cost to the project.

B. Testing equipment and devices
   1. Thirty days prior to start of testing the Contractor is to offer a list of test equipment make, model numbers and calibration data that will be used. Submit a manufacturer's technical data sheet or document that defines the device as capable to test to the applicable Standard.
   2. Test equipment must be capable of measuring the performance of the installed SCS and comparing the performance to the parameters specified in the applicable ANSI/TIA Standard.
   3. The following equipment list is provided to define the expected test equipment type. The test equipment is to be available for the entire test period through final System testing.
      a. Manufacturer – Fluke DSX series
         1) The most current software, firmware and appropriate launch cords must be used.

C. Horizontal twisted pair testing
   1. The horizontal distribution cable must be tested to perform in accordance with ANSI/TIA-568-C. Cables must meet or exceed the requirements for horizontal, twisted pair cabling as specified in ANSI/TIA 568-C for a "PERMANENT LINK" test.
   2. Any cable, which fails any given test, must be corrected or replaced. Such activity must be performed at no additional cost to the Owner.
      a. Only cables with PASS results will be accepted. Results that show PASS* will be considered a failed test.
      b. PASS* tests will be accepted if written approved is provided from the manufacturer providing the extended performance warranty on the system stating that these cable segments will be covered by the extended warranty.

D. Cable certification reports must bear the location/room number and cable identifier for each cable tested. Test results/reports in electronic copies by closet must be delivered to the Project Manager according to the submittal procedures.

E. The Contractor must deliver an electronic file containing all individual test records and the software required to display and print the test records using a typical personal computer (PC).

END OF SECTION

SECTION 27 41 16

INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Drawings (AV Series) and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. All materials, equipment, transportation, and labor necessary to achieve a complete and functional system

C. The work of this section also includes:
   1. Required licenses, insurance and permits including payment of charges and fees
   2. Verification of dimensions and conditions at the job site
   3. Preparation of submittal information
   4. Pick-up of owner furnished equipment and incorporation into project
   5. Development and implementation of AV control software code and control panel layouts, which will become the property of the owner
   6. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction
   7. Extension of electrical service, including ground, to equipment locations if required
   8. Initial tests and adjustments, written report, and documentation
   9. Instruction of operating personnel
   10. Provision of manuals
   11. Maintenance services and warranty

1.2 RESPONSIBILITY

A. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply systems in full working order. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

C. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, the Occupational Safety and Health Act and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

D. Conduit infrastructure system, including wire for AC Power and grounding for the Audio-Visual Systems, are provided by the contractor. Coordination between different disciplines is required to achieve a proper conduit system installation and power provisions for the Audio-Visual Systems. All electrical installation shall be in accordance with division 26 and the National Electric Code.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 26 - Electrical Work.
   1. Wall boxes, pull boxes, junction boxes, AC power circuits and ground wiring.

1.4 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
   1. American National Safety Institute (ANSI)
   2. American Society of Testing and Materials (ASTM)
   3. Electronics Industries Association (EIA)
   4. Federal Communications Commission (FCC)

5. National Electrical Manufacturer's Association (NEMA)
6. National Electrical Code (NEC)
7. Underwriters Laboratories (UL)
8. Occupational Safety and Health Administration (OSHA)
9. Building Industry Consulting Service International (BICSI)
10. Davis and Davis, Sound System Engineering (2nd Edition), Howard W. Sams, 1987
11. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 1990

1.5 DESCRIPTIONS AND REQUIREMENTS

A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the systems.

B. Competition Gym
   1. Audio System
      a. The competition gymnasium will be supplied with a sound reinforcement system which will provide sound coverage to the home and visitors bleacher sections as well as the court. The system is intended for both music and voice reinforcement.
      b. Input panels at both floor and wall locations at court level will accept microphone and line level signals. The floor locations will be located near the scorer's table at both the home and visitor's sides. The inputs will be controlled from the wall-mounted touch panel at the court level of the gymnasium without the need to connect any portable equipment into the system.
      c. Two (2) single-channel wireless microphone systems will be provided. The wireless microphones will also be controlled from the wall-mounted touch panel without the need to connect any portable equipment into the system
      d. A portable equipment rack will include a CD player for source playback and two (2 single-channel wireless microphone systems. All the source equipment will be controlled from an audio mixer within the portable rack.
      e. The audio system will utilize a digital signal processor (DSP) located in the equipment rack.
      f. A wireless, single channel, radio frequency hearing assist system provides coverage to the audience area for those with hearing difficulty and must operate on FCC approved frequencies. The transmitting unit will be located in the amplifier rack and the antenna will be remotely located in the gymnasium where it is protected from sports balls. Portable receivers will allow the users to be seated anywhere within the competition gym and will be equipped with a variety of listening devices including, ear speakers, lightweight headsets, and inductive coil loops. Provide receivers to meet the current ADA Standards.
      g. The amplifier and processing rack will be wall-mounted within the gymnasium. This rack will be hands free with operators controlling the system power from the locking wall-mounted touch panel nearby.
      h. The competition gym system will mute in case of a fire alarm and remain muted for the duration of the alarm. When the alarm condition has ended the system is to revert to the previous system configuration. This feature is to be implemented using control ports linked to system presets within the DSP.
      i. The gym audio system shall be programmed to mute if the campus intercom system requires notification or paging within the gymnasium. This feature is to be implemented using control ports linked to system presets within the DSP. When the campus intercom system completes the notification the gym audio system shall return to the previous system configuration.
   2. AV Presentation System
      a. The AV presentation system in the competition gym will provide a large screen projected display of video sources. The display will utilize a projection screen that is wall mounted and the screen will be motorized so that it can be raised (out of sight) when not in use.
      b. Projector will be located inside a ceiling mounted projector lift. The lift will have metal side panels to provide protection.
      c. All sources being shown on projector will be distributed from a rack-mounted matrix switcher. All sources have both video and audio components. Sources currently planned are:
         (1) Blu-ray player at the Gym Rack
         (2) Auxiliary Video inputs at 2 wall plate locations
         (3) Auxiliary Video inputs at 2 floor pocket locations
      d. Control of the AV presentation system (Projector power, Blu-Ray transport controls, source selection, Projector Lift stow-show-service, screen up-down etc.) should be simple and intuitive. Color touch screen control panel will be provided for use; one at the Gym Control Panel location

1.6 SUBMITTALS

A. General: Provide submittals in accordance with the project general conditions.

B. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the installer above 25% of the scheduled value of this work until all submittal information has been approved. Cost for the Owner's consultant to review secondary and re-submittals due to the Installer's failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Installer. The cost shall be based on the hourly rates of the architect and his consultants as published in their current professional fees schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost, plus ten percent (10%).

C. AV contract drawings will not be distributed for the use of developing the shop drawing submittal. Contact the General Contractor or the Architect for procedures in obtaining base building CAD backgrounds. Contractor to cover all costs associated with the processing of the files for distribution.

D. Provide submittals in the quantity specified in Division 1, General Requirements.
   1. Provide the following in one submission for approval within thirty days of issuance of Notice to Proceed and prior to commencement of Work:
      a. Complete schedule of submittals.
      b. Chronological schedule of Work in bar chart form.
      c. Provide an equipment list and manufacturer’s data sheets on product to be incorporated within the Work in specification order. Submit bound originals of:
         (1) Manufacturer's Products technical data for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.
         (2) Each submittal shall include a unique number and be numbered in consecutive order.
         (3) Provide a complete table of contents with the following information:
         (4) Project title and number
         (5) Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
         (6) Date of submission.
         (7) Referenced addendum or change order number as applicable.
         (8) Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
         (9) Bind submittal in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs
      d. Shop Drawings:
         (1) Copies of the contract documents shall not be used in generating submittal documents with the exception of architectural backgrounds.
         (2) Schematic: Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and designators, and device designators. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
         (3) Coordination Drawings:
         (4) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the systems in relationship with other building components. Prepare drawings to an accurate scale of 1/8”=1’-0” or larger on suitable sized media. Enlarged detail drawings executed at an appropriate scale, not less than 1/4”=1’-0”.
         (5) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the work including but not necessarily limited to the following: equipment housings, ceiling and wall mounted devices, raceways, cabling.
         (6) Equipment: Location of equipment in racks, consoles, or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
         (7) Full fabrication details of any custom enclosures and millwork indicating size, material, finish and openings for equipment.
         (8) Projector mounting details: Include hardware types and load capacity.
         (9) Fabricated Plates and Panels: Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
         (10) Labeling: Equipment and cabling labeling scheme: Include font sizes and styles, explanation of scheme, and designator schedule.

(11) Schedules: Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting, and location. Include this information with remainder of wiring diagrams.

e. Structural rigging and mounting details:
   (1) Structural rigging and mounting details of all loudspeakers suspended from or mounted to the building structure. These drawings will identify all types of hardware, fittings and materials to be used. Detail the product manufacturer, part numbers and load capacity of the hardware, fittings and materials selected. All loudspeaker structural rigging and mounting detail drawings shall be signed and sealed by a professional engineer licensed to practice in the State of Texas and will include a copy of the design calculations.
   (2) The signed and sealed drawings noted above to include the following:
   (3) Attachment method to building structure for suspended loudspeakers or mounted brackets.
   (4) Any secondary steel required for attachment to the building structure.
   (5) All fittings, hardware, materials, and cable used for suspended loudspeakers.
   (6) All custom brackets, mounts, suspension grids or trusses and loudspeaker cabinet frames or brackets not supplied by the manufacturer of the specific loudspeaker to be mounted or suspended.
   (7) Loudspeaker Pole details: Include foundation, material types, load capacity and wind loading information. Structural information to include design calculations and copy of engineer's seal licensed to practice in the State of Texas.

f. Custom Control Software programming for review: It is anticipated that the Owner and Owner's Representative will have a significant role in originating and reviewing certain software items although it is the Contractor's responsibility to develop this.

g. Any other pertinent data generated which is necessary to provide the Work.

E. Contract close-out submittals:
   1. Submit all close-out documents on a finalized CDR as well as a hard copy after substantial completion but prior to final inspection. The CDR shall be set up using a non-proprietary "PDF" format:
      a. Products Data: Products actually incorporated within the Work:
         (1) Manufacturer's data sheet for each type of Product by manufacturer and model or part number unless specified otherwise herein.
         (2) Supply manufacturer's serial numbers for each Product.
         (3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item
         (4) Each product's Owner/Instruction Manual. Provide high quality copies where necessary, with all text legible and illustrations of equal resolution and sharpness as the original manual. Faxed copies or copies with portions of the information missing or smeared are not acceptable.
         (5) Manufacturer's maintenance and care instructions
         (6) Separately bind list by manufacturer and model or part number of Products incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately
      b. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'–0".
      c. Test Reports: Recorded findings of Commissioning.
      d. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
         (1) Describe the operation of system capabilities.
         (2) Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
      e. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
      f. Provide copies of all current versions of the software programs of the various system components on CDR. Include all site files for the system configuration and internal device settings including passwords.
      g. Any other pertinent data generated during the Project or required for future service.
   2. Segregate documents containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding. Remove non-English pages and any blank pages from submittal.

F. Resubmission Requirements:
   1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
   2. Indicate any changes that have been made other than those requested.

1.7 QUALITY ASSURANCE

A. Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
   1. The primary business of Contractor shall be the installation of sound and video systems.
   2. No less than five years' experience with equipment and systems of the specified types.
   3. Experience with at least three projects involving Audio Visual systems for venues of this type and comparable scale within the last two years.
   4. Project Manager assigned to this project shall have experience on new theatrical facilities while employed with the Contractor. Provide name of project team with proposal.
   5. Be a franchised dealer and service facility for the manufacturer's products furnished.
   6. Maintain a fully staffed and equipped service facility with full time field technicians. Have at least one supervisory employee holding the certification of CTS-I by InfoComm International (ICIA). Proof shall be supplied as submittal item.
   7. At the request of the Owner, demonstrate that:
      a. Adequate plant and equipment is available to complete the work.
      b. Adequate staff with commensurate technical experience is available.

B. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
   1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
   2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
   3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

C. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship Products in its original container, to prevent damaging or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner, Products damaged during storage, handling or the course of construction.

1.9 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.10 WARRANTY

A. Warrant labor and Products for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or Products within the Warranty period without charge.

B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within eight (8) hours, and correct the deficiency within twenty-four (24) hours.

D. Provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Record Drawings.

E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment (OFE). Coordinate inspection visit with the Owner.

1.11 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide instruction to Owner designated personnel on the operation and maintenance of the System.

B. Develop instructional course based on the use of the system and manufacturer's recommendations. Provide a minimum of twenty-four hours of instruction.

C. Training Submittals:
   1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
   2. Following discussions with Owner, formally submit a Training and Event Attendance submittal two weeks prior to first training. Submittal shall:
      a. Include a separate page/entry for every training session.
      b. Indicate date, time, and approximate length of training session.
      c. Indicate person(s) conducting training.
      d. Indicate whether training will be videotaped.
      e. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
      f. Include signature and title lines for:
         (1) Owner acknowledging and accepting training schedule. Include both an accepted an rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
         (2) Countersigning by trainer indicating that training actually occurred.
         (3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
         (4) Owner's representative attending training at the end of the session shall initial that:
         (5) Training Occurred.
         (6) Training Materials were provided and left with Owner.
         (7) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
         (8) Training was generally sufficient for the proposed curriculum.
      g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)
      h. Following training occurrence, submit complete training records no later than 5 days following end of training. When training is conducted overall period of weeks, competed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

D. Contractor shall be present at the first two uses of each facility.

1.12 TECHNICAL SYSTEMS SOFTWARE LICENSE

A. Introduction:
   1. All proprietary software provided for the audio systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
   2. Contractor shall agree that 3rd party (e.g. manufacturer's) proprietary software provided with the system shall be subject to this agreement.
   3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms and the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
   4. Proprietary software shall be defined to include, but not limited to, device and system specific software and firmware designed to run on conventional computer based setup, or operate the system or its components.
   5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership:

1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
2. Except as expressly set forth in this paragraph, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of Owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modification, and Use:
   1. Source code shall be available to Owner for a period of not less than 15 years.
   2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of Owner and its representatives.
   3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right in Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
   4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.
   5. During the life of the system (defined as a period of not less than 10 years and not more than 15 years), the Contractor shall provide software updates in accordance with all necessary support requirements to maintain the system. This shall include a commitment to provide appropriate patches, fixes, and interface updates as necessary to maintain the operability and security of the system at a level commensurate with the original system.
      a. In the event that computer and or processor hardware refinements and updates are necessary to support software updates 7 years after substantial completion, said hardware will be provided to Owner at the agreed upon terms for change orders of the original contract.
      b. Labor shall be in accordance with change order rates of the original contract, as adjusted for inflation in accordance with conditions and limitations of the General Contractor or U.S. Bureau of Labor Statistics' Consumer Price Index (CPI).
   6. All hardware supplied shall support software updates for a period of not less than 7 years following substantial completion.

D. Warranties and Representations:
   1. Contractor represents and warrants to Owner that:
      a. It has necessary rights and authority to execute and deliver this Software license and perform its obligations hereunder and to grant the rights granted under this Software License to Owner.
      b. The goods and services provided to Contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners.
      c. The software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.
   2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.
   3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of function, performance, and quality.

B. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure.

2.2 GENERAL

A. Products quantity is as required. If a quantity is given, provide at least the given amount.

B. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide products of a given type from one manufacturer.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide products complying with the specified manufacturer's published specifications.

D. Take care during installation to prevent scratches, dents, chips, etc.

2.3 MANUFACTURERS AND PRODUCTS

A. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.

B. Where required provide manufacturer’s rack mount adapter or one manufactured by Middle Atlantic or Winstead.

2.4 MICROPHONES AND MICROPHONE ACCESSORIES

A. Wireless Microphone Receiver (WRLS, Type 1)
   1. Acceptable Product to include:
      a. Shure QLXD4 receiver
      b. Shure UA221 passive antenna splitter
      c. Shure UABIAST power inserter
      d. Shure UA834 antenna amplifier (ANT-M)

B. Handheld Wireless Microphone (Type 1)
   1. Acceptable Product to include:
      a. Shure QLXD2/SM58-G50 handheld transmitter
      b. Shure SB900A rechargeable battery

C. Battery Charger (Type 1)
   1. Acceptable Product:
      a. Shure SBC200 dual-docking charger

D. Vocal Microphone (Type 1):
   1. Handheld dynamic cardioid pattern
   2. Acceptable Product:
      a. Audix OM6
      b. Shure SM58
      c. Approved equivalent

E. Microphone Switch (Type 1)
   1. Push to talk
   2. Table top
   3. Acceptable Product:
      a. ProCo SAS2
      b. Whirlwind THS 1T
      c. Approved Equivalent

F. Microphone Stands and Mounting Hardware
   1. Provide the following:
      a. Type 1: Round-base floor stand, black
         (1) Atlas MS-10CE, PB11XEB
         (2) Approved equivalent
      b. Type 2: Heavy duty floor stand, black
         (1) Atlas SB11WE
         (2) Approved equivalent
      c. Type 3: Boom arm short, black
         (1) Atlas PB11XEB
         (2) Approved equivalent
      d. Type 4: Boom arm long, black
         (1) Atlas PB21XEB
         (2) Approved equivalent
      e. Type 5: Table top stand, black
         (1) Atlas SMS2B
         (2) Approved equivalent

2.5 INPUT SOURCES

A. Media Player (MDP, Type 1):
   1. Acceptable Product:
      a. Tascam CD-200BT

B. Blu-Ray Player (BR, Type 1):
   1. Acceptable Product:
      a. Denon DN-500BD MKII

C. Line-Level Stereo Input Plate (LI, Type 1):
   1. RCA and 3.5mm stereo input jacks
   2. Stereo balanced output
   3. Output connections on detachable terminal block
   4. Final color and finish to be coordinated with Architect prior to purchase.
   5. Acceptable Product
      a. RDL D-CIJ3D
      b. RDL DS-CIJ3D
      c. Approved equivalent

D. Bluetooth Transceiver (BT TX, BT RX, Type 1)
   1. 1-gang wall plate
   2. Balanced outputs
   3. No device profile memory
   4. Customizable name
   5. Acceptable Product:
      a. Atterotech unBT2A
      b. Approved equivalent

E. Mono DI Box (Type 1):
   1. Inputs for unbalanced line sources
   2. ¼” inputs
   3. Line and mic level outputs
   4. Ground lift switch
   5. Acceptable Product:
      a. Whirlwind DIRECTOR
      b. Radial ProDI
      c. Approved equivalent

F. Stereo DI Box (Type 1):
   1. Inputs for stereo/dual mono unbalanced line sources
   2. ¼”, RCA, and 3.5mm inputs
   3. Line and mic level outputs
   4. Ground lift switch
   5. Acceptable Product:
      a. Whirlwind DIRECT2

b. Radial ProAV2
c. Approved equivalent

2.6 CONSOLES AND MIXERS

A. Portable Rack Mixer (MIXER, Type 1):
1. Acceptable Product to include:
a. Behringer XR16
b. iPad/Android tablet, including:
(1) Otterbox Latch II
(2) Otterbox Defender series

2.7 AUDIO SIGNAL PROCESSING

A. General:
1. The DSP system and control software shall be operational 30 days prior to the first use of the installed system.
2. Function: Provide all signal processing and control required for gymnasium audio system. Virtual devices required include, but are not limited to; mixer, matrix router, crossover, high and low pass filters, delay, compression, 6-band parametric equalizer, limiter, ducker, signal delay, and external control.
3. Unit to be configured with a minimum quantity of inputs and outputs as shown within the AV drawings, including control port requirements.
4. Provide additional I/O expanders to accommodate input/output requirements.
5. Provide interface to allow control of system from a third-party outboard control system.
6. Interior configuration of signal flow and routing to be fully user configurable.
7. Unit to permit hardwire connection of external switches for recalling presets.
8. Unit to permit remote networked control via dedicated devices.
9. Access to external user-adjustable controls to be restricted.

B. Digital Signal Processor (DSP, Type 1):
1. Acceptable product:
a. QSC Q-Sys Core 110f w/SL-QUD-110-P UCI software license and SL-QSE-110-P scripting engine license.

C. DSP Input / Output Expansion (DSP IO, Type 1)
1. Acceptable Product:
a. QSC I/O-8 Flex

2.8 SWITCHES

A. AV Network Switch (SWITCH, Type1)
1. 10, 24, or 48 ports as required
2. PoE+
3. Pre-configured for operation with the Q-Sys platform
4. Acceptable Product:
a. Q-Sys NS series

2.9 POWER AMPLIFIERS

A. General
1. Amplifier to adhere to the EIA standards RS-490 power rating at 1% THD into 70-volt constant voltage load or 8Ω load as applicable.
2. Provide protection of circuit components in the event of input over-drive, output overload, or short circuits.
3. Frequency Response: ±1dB, 20Hz to 20kHz with less than 1% THD at rated output.
4. Input Impedance: 10kΩ balanced.
5. Output Regulation: 2dB from no load to full load conditions.
6. Noise Generation: at least 85dB below rated output with input shorted.

B. Type 1 Amplifier
1. 4 channels
2. 1200W max output per channel @ 8Ω, all channels driven
3. Acceptable Product:
a. QSC CXD4.5Q

C. Type 2 Amplifier
   1. 8 channels
   2. 2000W max output per channel @ 8Ω, all channels driven
   3. Acceptable Product:
      a. QSC CXD8.8Q

2.10 LOUDSPEAKERS

A. Type 1 Speaker
   1. Gymnasium full-range loudspeaker
   2. Power Rating (Continuous / Program / Peak): 375W / 750W / 1500W
   3. Impedance: 8Ω
   4. Acceptable Product:
      a. JBL AC28/95

B. Type 2 Speaker
   1. Gymnasium subwoofer
   2. Dual 12” drivers
   3. Power Rating (Continuous): 1100W
   4. Impedance: 4Ω
   5. Acceptable Product:
      a. QSC GP212-sw

C. Type 3 Speaker
   1. Portable self-powered loudspeaker
   2. Acceptable Product:
      a. JBL PRX815

2.11 ASSISTIVE LISTENING SYSTEM (ALS)

A. ALS Transmitter (ALT, Type 1):
   1. Configuration: Single-channel.
   2. Frequency: 216 MHz.
   3. Audio Input: Balanced, mic or line level, 3-pin XLR.
   4. Provide power supply.
   5. Provide 1-RU rack mount bracket.
   6. Acceptable Product:
      a. Listen LS-71-216

B. ALS Receiver (Type 1):
   1. Configuration: Single channel.
   2. Frequency: 216 MHz.
   3. Frequency agile to adjust various systems.
   4. Receivers to be frequency adjustable.
   5. Include an individual price for owner to purchase additional receivers.
   6. Acceptable product:
      a. Listen LR-4200-216 Receiver (include each of the following)
         (1) Listen LA-401 Ear Speaker
         (2) Listen LA-402 Headset
         (3) Listen LA-430 Neck Loop

2.12 VIDEO PROJECTION EQUIPMENT

A. Video Projector (PROJ, Type 1)
   1. 1-Chip DLP WUXGA Laser Projector
   2. Brightness 12,000 ANSI lumens
   3. Native resolution 1920x1200
   4. Control Communication RS-232C
   5. Field verify throw distance to determine the appropriate lens
   6. Provide required lens
   7. Acceptable Product to include:
      a. Panasonic PT-RZ120

2.13 PROJECTION SCREENS

A. Competition Gym Projection Screen (PS, Type 1)
   1. Wall Mount Electric Projection Screen
   2. Low Voltage Controller
   3. Screen size = 120” x 192”
   4. Da-Mat Fabric
   5. RS-232 control
   6. Mount so bottom of viewing area is at 9' above finished floor
   7. Acceptable Product:
      a. Da-Lite Tensioned Large Cosmopolitan Electrol w/Dalite SCB100

2.14 PROJECTOR AND DISPLAY MOUNTING EQUIPMENT

A. Projector Lift (VPL, Type 1):
   1. Flush-mounted
   2. Three positions: stowed, show, service
   3. Low voltage and 232 control
   4. Install according to manufacturer’s instructions for plenum ceilings
   5. Provide projector mount
   6. Acceptable Product:
      a. Display Devices DL3W w/OPT-3L plenum housing and closure frame. OPT-11-B Cabling pre-wire. Reference Display Devices quote: SO46992

2.15 VIDEO SWITCHING AND PROCESSING EQUIPMENT

A. Digital Matrix Switcher (MXSW, Type 1)
   1. Three HDBaseTTM four HDMI®, and one multi-function analog video input
   2. Dual, mirrored HDBaseT and HDMI outputs
   3. RS-232 insertion from the Ethernet control port
   4. 4K/UHD capability @ 60 Hz with 4:2:0 chroma subsampling
   5. Front panel controls
   6. 1 RU
   7. PoE (Power over Ethernet) source
   8. Acceptable Product:
      a. Atlona AT-UHD-CLS0-824

B. HDBaseT Transmitter (TX, Type 1):
   1. 4K/UHD capability @ 60 Hz with 4:2:0 chroma subsampling
   2. 2×1 HDBaseT switcher with HDMI and USB-C inputs.
   3. HDBaseT transmitter for AV, power, and control up to 330 feet (100 meters).
   4. Remotely powered via PoE (Power over Ethernet)
   5. TCP/IP and RS-232 control
   6. Acceptable Product:
      a. Atlona HDVS-210U-TX-WP

C. HDBaseT Receiver (RX, Type 1):
   1. 4K/UHD capability @ 60 Hz with 4:2:0 chroma subsampling
   2. HDCP 2.2 compliant
   3. HDBaseTTM receiver for HDMI®, Ethernet, power, and control up to 330 feet (100 meters)
   4. PoE (Power over Ethernet) source
   5. Receives RS-232, CEC, and Ethernet control signals over HDBaseT
   6. HDCP 2.2 compliant
   7. Multi-channel audio compliant for all PCM, Dolby®, and DTS® formats
   8. Acceptable Product:
      a. Atlona AT-UHD-EX-100CE-RX-PSE

2.16 CONTROL SYSTEM

A. Software:
   1. Owner shall retain all rights and non-exclusive ownership to custom software, including original source code. Supply printouts of all source codes as well as back-up copies of uncompiled code on suitable electronic storage medium.

2. All commercial software used, shall be registered to Owner, in Owner's name. Owner to be supplied with all software documentation including copies of software registration.
3. All software shall be written with remark statements which document function of subroutines and program requirements.
4. Deliver final copies of the configured software within 30 days after notice to proceed.
5. Provide one-year of on-site software upgrades from date of substantial completion.
6. Submit complete software “code” on drive format for approval.
7. Initial and final software configuration to be included. The cost to configure the software is a part of this contract. Software configuration involves extensive interviews with Architect’s Consultant and Owner.

B. Graphical User Interface (“GUI”) and Machine Control:
1. The Contractor is to develop the GUI and machine software control. The development is to be done in four phases.
2. During the first phase, development of the GUI panel layouts and machine functions are to be established. Participants of the development are the Contractor, the Architect’s Consultant via teleconference, and the Owner. This requires multiple meetings with these principles and is an interactive and iterative process.
3. During the second phase, the Contractor produces the initial GUI and machine software control filling the requirements developed during the first phase. This also requires multiple meetings with the Contractor, the Architect’s Consultant via teleconference, and the Owner and is an interactive and iterative process.
4. Upon completion of the second phase, install the control software within the AV Control Systems and inspect the systems for performance compliance. During this process the Contractor debugs the AV Control Systems software code as required to ensure a properly functioning system. At the end of this phase the Contractor is to provide written notification that their product is operating properly and that the functions and configurations established in Phase One and Two are working and have been properly implemented.
5. During the fourth phase, the Contractor, the Architect’s Consultant, and the Owner inspect the operational aspects of the Systems and develop final software configurations. Upon completion of final configuration, this Contractor and the Manufacturer installs and debugs the final Control Systems software code as required to ensure a properly functioning system as established during the fourth phase.

C. Touch Panel (TP, Type 1)
1. 11.6" capacitive touchscreen
2. 1920 x 1080 resolution
3. 350 Nits
4. PoE
5. Acceptable Product:
   a. QSC TSC-116w-G2VP

2.17 POWER SYSTEMS

A. Remote Power Sequencing Systems
1. Remote Power Sequencing (RPS) system to be operated via low voltage button contact closures from either push buttons located on panels local to the event space or via a contact closure from a relative control system (DSP, Control Processor, etc.)
2. Devices to be sequenced “ON” in order of signal flow. Devices and equipment to be shut down in reverse order from “ON” sequence. Example “ON” order starting with:
   a. Source devices. (Media Players, Pre-amplifiers, etc.)
   b. Processing devices (DSP, Mixers, Video Switchers, etc.)
   c. Output devices (Amplifiers, Powered Speakers, etc.)
3. Devices not to be sequenced and to remain on for status and monitoring purposes to include but not limited to:
   a. Network switches and components.
   b. Equipment housing ventilation systems.
   c. Control system equipment responsible for providing control of Remote Power Sequencing system.
4. Coordinate wiring of high voltage components with electrical contractor.

B. Remote Power Sequencing System (RPS, Type 1)
1. Modular raceway power system.
2. Rack mountable vertical distribution.
3. Low voltage contact closures.
4. 6 circuit sequencing.
5. Acceptable Product:
   a. Middle Atlantic MPR-xA
      (1) Middle Atlantic MPR-SEQA (Sequencer)

(2) Middle Atlantic RLM-20A (Switched Module, as needed)
(3) Middle Atlantic M-20A (Un-switched Module, as needed)

C. Power Protection (SURGE):
1. Provide surge protection device to maintain clean power to the following equipment:
a. All DSP Units
b. CPU Based processing equipment
2. Provide product package most suitable for installation method required by equipment and its location.
3. Acceptable products:
a. Surge-X SX-1120RT
b. Surge-X SX20-NE
c. Surge-X ICE-20C

D. Power Protection with Lights (POWER/LIGHT):
1. Provide a 20 Amp power system.
2. Eight switched AC outlets.
3. Remote power turn on.
4. Acceptable product:
a. Furman Sound PL-PRO C
b. Approved Equivalent

E. Uninterruptible Power Supply (UPS)
1. Provide UPS systems to maintain power to all computer CPU's and associated video monitors.
2. UPS's shall be on-line style with sufficient battery reserve to operate for 15 minutes. Size each UPS unit for 25% additional capacity.
3. 2-RU Rack mountable.
4. Acceptable product:
a. Middle Atlantic UPS-1000R
b. APC Back-UPS CS 500

2.18 EQUIPMENT HOUSING AND ACCESSORIES

A. Wall Mounted Equipment Rack (ER-GYM)
1. Finish: Textured black powder coat
2. Tapped 10-32 rack rails
3. Provide side, top, and bottom panels
4. Provide ventilated locking door
5. Acceptable Product:
a. Middle Atlantic DWR series

B. Portable Equipment Rack (Type 1)
1. Size: 12RU front with 14RU top
2. Detachable custom height lid
3. Tapped 10-32 rack rails
4. Acceptable Product:
a. Gator G-Tour-GRC12X12

C. Rack Fan
1. 10" or 4.5" (x4), 115V.
2. Include cord and hardware.
3. Acceptable products:
4. Middle Atlantic FAN10 with GUARD-10
5. Middle Atlantic FAN with GUARD

D. Fan Thermostat Control
1. Switched 15A duplex outlet.
2. Temperature Range: 50 – 90 Degrees.
3. On and Stand-by LED indicators.
4. Integral mounting ears.
5. Provide for each rack fan assembly.
6. Acceptable product:
a. Middle Atlantic FC-4-1C

E. Temperature Display (TD, Type 1)

1. 1RU/decora mount
2. Alarm out contact closure
3. Customizable over-temperature settings
4. LED display
5. Acceptable Product:
    a. Middle Atlantic T1P

F. Rack Blanks
1. Flanged, aluminum panel.
2. Blank anodized finish.
3. Provide where shown on drawings.
4. Acceptable product:
    a. Middle Atlantic BL series

G. Rack Drawers
1. Blank anodized finish.
2. 2-RU and 3-RU rack mountable sizes.
3. Acceptable product:
    a. Middle Atlantic D series

H. Wireless Rack Drawers
1. Blank anodized finish.
2. 2-RU rack mountable.
3. Provide with internal foam lining custom cut for transmitter storage.
4. Acceptable product to include:
    a. Middle Atlantic D series
    b. Middle Atlantic FI-* Foam Kit

2.19 PLATES AND PANELS

A. Provide plates and panels and as described in Drawings. Engrave as shown on Drawings. Other Plates and Panels may be required to satisfy the requirements of the Work.

B. Custom panels shall be 1/8-inch thick aluminum, standard EIA sizes, brushed black anodized finish unless otherwise noted. Brush in direction of aluminum grain only.

C. Plate finish shall be coordinated with the Architect. Plastic plates are not acceptable.

D. Panel, plate and label engraving shall be 1/8-inch block sans serif characters unless noted otherwise. On dark panels or pushbuttons, letters shall be white; on stainless steel or brushed natural aluminum pushbuttons, letters shall be black.

E. Acceptable Manufacturer for Plates and Panels:
1. RCI
2. ProCo
3. Radial Engineering
4. Extron (where appropriate

2.20 CABLES AND WIRING

A. General:
1. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g. CMR, CMP, etc.)
2. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
3. Where cables are routed through cable tray, provide tray rated cable of equal specification.
4. Where cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.
5. Shielded cables located in raceways shall have aluminum foil shield with drain wire.

B. Microphone/Instrument Cables:
1. Cable properties:
    a. Quad 24 gauge stranded with braided shield, flexible hard service jacket.

b. Color: Black
c. Each cable to be provided with a Velcro style tie wrap.
(1) Minimum 5/8” width
(2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-inch diameter.
(3) Standard of performance:
(a) Rip-Tie CABLEWRAP

2. Microphone Cable:
a. Type 03 – 3 foot, with Brown collar on male connector
b. Type 06 – 6 foot, with White collar on male connector
c. Type 10 – 10 foot, with Red collar on male connector
d. Type 15 – 15 foot, with Orange collar on male connector
e. Type 20 – 20 foot, with Yellow collar on male connector
f. Type 25 – 25 foot, with Green collar on male connector
g. Type 30 – 30 foot, with Blue collar on male connector
h. Type 50 – 50 foot, with Violet collar on male connector
i. Type 100 – 100 foot, with Grey collar on male connector

3. 3.5mm TRS Cable
a. Type 2 – 2 foot, 3.5mm TRS to 3.5mm TRS
b. Type 6 – 6 foot, 3.5mm TRS to 3.5mm TRS
c. Type 10 – 10 foot, 3.5mm TRS to 3.5mm TRS

4. Acceptable cable:
a. Whirlwind MKQ series
b. Canare StarQuad
c. ProCo AmeriQuad

C. Microphone Snake (Type 1):
1. 6 Channel
2. 3 returns
3. Male to Female XLR connectors
4. Each cable to be provided with a Velcro style tie wrap.
a. Minimum 5/8” width
b. Length appropriate to wrap minimum 1.5 times around a cable loop of 14-inch diameter.
c. Standard of performance:
(1) Rip-Tie CABLEWRAP

5. Acceptable Product:
a. WhirlwindUSA MS-6-3-XL-100
b. Approved Equivalent

D. Ethernet (Category) Audio Cables:
1. Cable properties:
a. Color: Purple
b. Neutrik Ethercon Connector
c. Rugged Tactical Jacket
d. Stranded Conductor
e. Each cable to be provided with a Velcro style tie wrap.
(1) Minimum 5/8” width
(2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-inch diameter.
(3) Standard of performance:
(a) Rip-Tie CABLEWRAP

2. Ethernet Cable:
a. Type 03 – 3 foot, with Brown collar on male connector
b. Type 06 – 6 foot, with White collar on male connector
c. Type 10 – 10 foot, with Red collar on male connector
d. Type 15 – 15 foot, with Orange collar on male connector
e. Type 20 – 20 foot, with Yellow collar on male connector
f. Type 25 – 25 foot, with Green collar on male connector
g. Type 30 – 30 foot, with Blue collar on male connector
h. Type 50 – 50 foot, with Violet collar on male connector
i. Type 100 – 100 foot, with Grey collar on male connector

3. Acceptable cable:
a. Clark Wire CN424C5TF
b. Belden DataTuff
c. ProCo ProCat

E. Speaker Cables:

1. Cable properties:
   a. Color: Black,
   b. Connector: NL4 to NL4 or NL8 to NL8
   c. Wire: 12 gauge stranded, SJ jacket.
   d. Each cable to be provided with a Velcro style tie wrap.
      (1) Minimum 1" width
      (2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-18 inch diameter.
      (3) Standard of performance:
         (a) Rip-Tie CABLEWRAP
2. Speaker Cable:
   a. Type 03 – 3 foot, with Brown collar on male connector
   b. Type 06 – 6 foot, with White collar on male connector
   c. Type 10 – 10 foot, with Red collar on male connector
   d. Type 15 – 15 foot, with Orange collar on male connector
   e. Type 20 – 20 foot, with Yellow collar on male connector
   f. Type 25 – 25 foot, with Green collar on male connector
   g. Type 30 – 30 foot, with Blue collar on male connector
   h. Type 50 – 50 foot, with Violet collar on male connector
   i. Type 100 – 100 foot, with Grey collar on male connector
3. Acceptable cable:
   a. Whirlwind SK5 series
   b. Approved Equivalent

F. Power Extension Cables:
1. Cable properties:
   a. Color: Black,
   b. 12-gauge, 3-conductor, stranded, flexible hard service jacket.
   c. Each cable to be provided with a Velcro style tie wrap.
      (1) Minimum 1" width
      (2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-18 inch diameter.
      (3) Standard of performance:
         (a) Rip-Tie CABLEWRAP
2. Power Extension Cable:
   a. Type 06 – 6 foot,
   b. Type 12 – 12 foot,
   c. Type 25 – 25 foot,
   d. Type 50 – 50 foot,
   e. Type 100 – 100 foot,
3. Acceptable cable:
   a. ProCo E-Cords series
   b. Approved Equivalent

G. XTP/DTP Twisted Pair Cable:
1. Shielded Twisted Pair:
2. Meets HDBT requirements.
3. 475 MHz up to 300 feet (91.4 m)
4. 24 AWG solid copper construction
5. SF/UTP design
6. Acceptable Product:
   a. Extron XTP DTP Series

H. Control Level Wire
1. Provide unshielded 22 AWG cable.
2. Cable to be CMR or CMP rated.
3. Provide number of conductors where required.
4. Acceptable Product:
   a. West Penn 27x Series
   b. West Penn 2527x Series (where required)

I. Relay Control Wire
1. Provide unshielded 22 AWG cable.
2. Cable to be CMR or CMP rated.
3. Provide number of conductors where required.
4. Acceptable Product:

a. West Penn 27x Series
b. West Penn 2527x Series (where required)

J. Wireless Microphone Antenna Cable
1. RG8X/U type
2. BNC-BNC
3. 50 Ohm
4. Acceptable Product:
a. Shure UA8 series cables
b. Belden equivalent

K. Wireless /Assisted Listening Antenna Cable
1. 16-gauge, stranded center conductor
2. RG8/X
3. 95% braided shield
4. Acceptable Product:
a. Belden 9258

L. Antenna Cable
1. Provide 10 AWG cable.
2. 50 ohm, double shielded
3. Cable to be CMP rated.
4. Jacket color: black.
5. Acceptable Product:
a. Belden 7733A

M. Microphone/Line Level Wire
1. Provide shielded 22 AWG cable.
2. Cable to be PVC jacketed.
3. Jacket color: black.
4. Acceptable Product:
a. Belden 9451
b. Liberty 22-1P-EZ
c. Belden 88761 (where required)
d. Liberty 22-2C-PSH-WHT (where required)

N. Speaker Level Wire
1. Provide 14 AWG cable.
2. Cable to be CL3R or CL2P rated.
3. Jacket color: gray.
4. Acceptable Product:
a. West Penn 226
b. West Penn 25226 (where required)

O. Video Cable, Intra Rack, Non Plenum
1. Provide RG-59/U type cable.
2. Center conductor 23 AWG solid.
3. Cable to be PVC or FEP jacketed.
4. Acceptable Product:
a. Belden 1505A
b. Extron 22-124-XX
c. West Penn 819

P. Video Cable Non Plenum
1. Provide RG-6/U type cable for cable runs over.
2. Center conductor 18 AWG solid.
3. Cable to be PVC or FEP jacketed.
4. Acceptable Product:
a. Belden 1694A
b. Extron 22-098-XX
c. West Penn 6350

Q. Video Cable Plenum
1. Provide RG-6/U type cable.

2. Center conductor 18 AWG solid.
3. Cable to be PVC or FEP jacketed.
4. Acceptable Product:
   a. Belden 1695A
   b. Extron 22-164-XX
   c. West Penn 256350

R. HDMI Cable:
1. Provide pre-molded cables in lengths as required
2. Acceptable Product:
   a. Extron Ultra Series HDMI Cable

S. Other Misc. Cables
1. Acceptable Product:
   a. As per manufacturer specifications

2.21 CONNECTORS

A. XLR Panel mount Connectors
1. Provide panel mount XLR connectors with unified metal shell.
2. RF-Protector connectors.
3. Shell Color: Black.
4. Contacts: Silver.
5. Terminations: Solder.
6. Acceptable Product:
   a. Male Connectors: Neutrik NC*MD-L-1-BAG Series
   b. Female Connectors: Neutrik NC*FD-L-1-BAG Series

B. XLR Cable Connectors
1. Provide XLR cable connectors with die cast shell.
2. No-screw type assembly.
3. Chuck-type strain relief.
4. Shell Color: Black.
5. Contacts: Silver.
6. Terminations: Solder.
7. Acceptable Product:
   a. Male Connectors: Neutrik NC*MX-BAG Series
   b. Female Connectors: Neutrik NC*FX-BAG Series

C. BNC Cable Connectors
1. Provide cable mount BNC connectors.
2. Contacts: Brass or copper.
3. Terminations: Crimp.
4. Acceptable Product:
   a. Kings
   b. Amp
   c. Amphenol
   d. Canare
   e. Liberty

2.22 MISCELLANEOUS EQUIPMENT

A. Headphones (Type 1):
1. Acceptable Product:
   a. Sony MDR-7506
   b. Shure SRH440
   c. Approved Equivalent

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final Products.

B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.

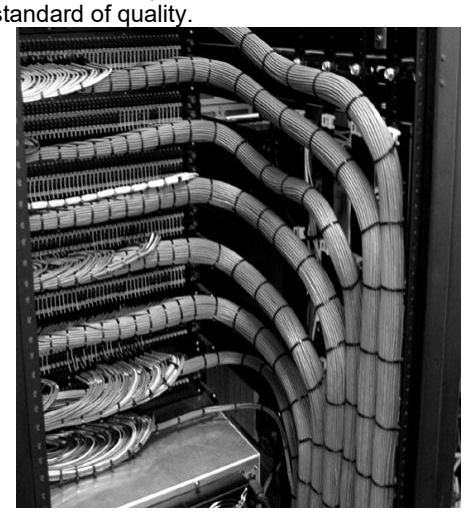
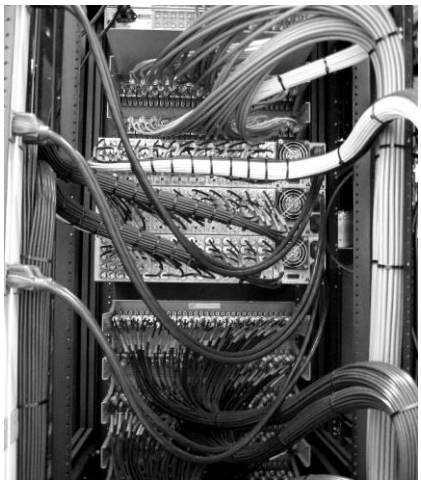
E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 INSTALLATION

A. Installation of cable and wiring
   1. Cabling and Wiring:
      a. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
      b. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
      c. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
      d. Horizontal distribution cables shall be bundled in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
      e. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
      f. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
      g. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.
      h. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
      i. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
      j. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.
      k. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors specifically intended for the type and class of cable being used. Where spade lugs are used, crimp properly with ratchet type tool.
      l. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
      m. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.
      n. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.

o. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
p. Execute wiring in strict adherence to:
(1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co., 1990.
(2) Don Davis and Carolyn Davis. Appendix II, Recommended Wiring Practices. Sound System Engineering, 2nd Edition. Indianapolis: Howard W. Sams & Co., 1989.
(3) AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009

2. Equipment Housing Cabling and Wiring:
a. Lace, tie, or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire or cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Reference photos below for standard of quality.

b. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.
c. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
d. Provide plastic cable ties or Velcro straps to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
e. Install with connections completely visible and labeled.
f. Provide termination resistors, if required, of 5 per cent tolerance; fully visible and not concealed.

B. Installation of connectors, plates & panels:
1. Install panel mounted connectors rigidly attached to panels, plumb and level.
2. Custom rack panels shall be 1/8 inch thick aluminum, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.
3. Custom connector plates (speaker, microphone, etc) are typically stainless steel, unless otherwise noted or specified. However, verify plate finish with the Architect.
4. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
5. Other Plates and Panels may be required to satisfy the requirements of the Work.

C. Installation power and grounding:
1. Coordinate final connection of power and ground wiring to housings.
2. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
3. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
4. Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.
5. Replace manufacturers supplied 18 gauge IEC power cords with UL listed 18 gauge pre-molded 6”, 12”, 18”, or 24”. Use minimum length required. No looped or cable tied IEC power cords will be permitted within the equipment rack.

6. Replace manufacturers supplied 14 gauge IEC power cords with UL listed 14 gauge pre-molded 18" or 36" for all equipment IEC capable. Use minimum length required and minimize looped or cable tied IEC power cords present in the equipment rack.

D. Installation of electronic equipment:
   1. Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
   2. Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
   3. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamicoid labels.
   4. Mount equipment plumb and level, firmly and safely held in place.

E. Installation of equipment housing:
   1. Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks will be fabricated on site and the reasons for the change.
   2. Provide rear support for housing mounted equipment greater than 15 inches deep.
   3. Provide blank panels to fill unused panel space within the equipment housing.
   4. If Key door locks are required, key each housing type alike.
   5. Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, and RF wiring on the right.
   6. Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the conclusion of testing.
   7. If forced air active thermal management is used, provide ventilation blocking material on the front, sides, and rear of the equipment rack as needed. Reference Middle Atlantic Products "Controlling the Temperature Inside Equipment Racks".
   8. Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.
   9. If equipment rack is not equipped with casters, provide two inch high wood base to isolate equipment rack from floor. Wood base should be capable of supporting the load.

F. Installation of loudspeakers:
   1. Loudspeakers shall be mounted at the operating position in a safe, secure and permanent manner.
   2. Rigging, mounting and support systems for loudspeakers shall be reviewed and certified by a registered Professional Engineer (PE) licensed to practice in the State in which the project is located. Documentation shall be included as a submittal item. Once the systems are installed, the PE shall physically inspect the methods and means used to verify compliance with the original design.
   3. Paint speakers, supports and related hardware color as directed by Architect.
   4. The aiming direction of all loudspeakers shall be adjustable by ±5 degrees vertically.
   5. Structural support members to have a safety factor of at least five. Mounting hardware and wire rope to have a safety factor of eight. All fasteners to be graded and certified for use in the intended applications. Overhead suspension hardware shall comply with ASME B30.20 standards and all applicable local building and safety codes. Overhead suspension hardware must be of a type that includes product traceability controls.
   6. Provide safety cable on all bracket mounted loudspeakers.
   7. All loudspeakers located in ceiling tiles shall be located in the center of the tile unless noted otherwise.

G. Installation of projectors:
   1. Projectors shall be mounted plumb and level at the operating position in a safe, secure and permanent manner.
   2. All hardware required to locate the mount and projector at the required location shall be provided.
   3. Projectors shall be mounted using tamper proof secure hardware.
   4. Contractor may be required to adjust projection screen and lift upper and lower limit switches for projection screens and lifts specified elsewhere and not installed as part of this Contract.

3.3 FIRESTOP

A. A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane

penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.

C. Fire-stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed.

D. A drawing showing the proposed fire-stop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the fire-stop system(s).

E. All fire-stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for observation by the local authorities prior to cable system acceptance.

3.4 CONTROL SYSTEM PROGRAMMING

A. Transport Control
1. Provide standard Stop, Play, Pause, Fast Forward and Rewind for each playback device and menu control for DVD players. Buttons should be arranged in a conventional fashion that will be familiar to the normal user.
2. The selected control function should be displayed by showing the appropriate button "pressed". It should remain this way until another function is selected.
3. For devices that will go into a standby mode after a period of time, the control system shall sense this mode and restore normal operating mode once a transport function has been selected. This may require the use of current sensors to determine the state of the unit. No direct user action should be required at the playback device to restore the normal operating mode.

B. Screen/Shade Control
1. In addition to up-down functions, provide a Stop function to allow the movement to be halted. Once movement has been stopped, the up or down buttons should resume travel in the selected direction.
2. Control system shall not prevent screen/shade wall controls from being used as well.
3. Touch panel controls should be readily accessible to the user to permit direct control of shades or screen with having to navigate through multiple control pages.

C. Level Control
1. Objects requiring level adjustment such as volume or tone controls shall be through Up/Down buttons with a graphical representation of the actual level.
2. Increment of level change to be adjusted for reasonable range without the need to push the Up or Down buttons needlessly.

D. Volume Mute
1. Where the ability to mute the sound is needed, the button shall use the label "Vol On" and "VOL OFF" instead of Mute and Unmute. When in a "VOL OFF" mode, pushing the "VOL UP" button shall restore the sound and bring the system out of the muted mode.
2. VOL ON/OFF buttons shall change color to indicate the status of the button.

E. Standard Colors
1. Control functions shall be color coded to add clarity and show relationships between different groups of controls.
2. The color Red shall be reserved to indicate a fault or abnormal condition.
3. Green may be used to indicate normal operation, but may be used for standard control colors as well.
4. Similar controls should maintain the same color scheme across all control pages.
5. When a function is selected, the graphical depiction of that button should appear to be pressed and its color change to a darker shade of the regular button color.
6. Color schemes used for background and foreground objects should be selected to be complimentary and provide a consistent theme throughout the control pages.

F. Minimum Button Size and Placement
1. Minimum visual size of a button is 3/8" wide by 1/4" high.
2. Spacing between buttons should be no less than 1/16".
3. Where buttons are immediately adjacent, the active selection area of the button should be reduced to 80% of the visual area of the button.

G. Button Actions

1. When a function on a control page is selected, that button or visual object associated with that function should change to reflect what has been chosen.
2. For functions that are momentary selections (i.e. VOL UP), the change of state is visible for as long as the button is being pressed.
3. For function that are maintained selections (i.e. PLAY), the change of state remains visible until another function is selected and resets the previous function..
4. The state change of a button or visible object should depict real-world objects as much as possible including the appearance of the button be pressed inward, change in shade of the original color, but not a change in hue.

H. Labels
1. Use of simple words or titles are preferred to indicate functionality, navigation and system status.
2. Use of stylish symbols should be avoided unless their identity is commonly recognized by the general public. Standard symbols for transport functions are acceptable.
3. Labels should be presented in a clear, sans serif type face that will remain legible on lower resolution touch panels.
4. Where physical buttons are present along the side of a touch panel, these buttons should be engraved and filled with a contrasting color.

I. Power On/Off
1. For panels requiring an ON/OFF control, these functions should be linked through current sensors or other methods for the control system to detect the power on condition of the component being controlled.
2. Powering off a system should not interfere with the ability of a projector to complete its cool down cycle.

J. Look & Feel
1. Control pages should utilize a clean, elegant but stylish appearance.
2. Use a common graphical template across all control pages for a consistent look.
3. The touch screen layout should utilize graphical elements such as drop shadows, gradient fills and transparency to provide a pleasing overall appearance.
4. Utilize graphical representations of floor plans to convey location information.
5. Include company logos, icons or watermarks to portray the corporate identity.
6. Provide clear navigation tools for moving between control pages.
7. Each sub-page should have a “BACK” button to return to the previous page. This button should appear in the same location on each page.
8. Provide a “HELP” button or icon on each user page to provide clear, non-technical instructions on how to use the functions available to regular users.

K. Security
1. Provide password access to control pages not intended to be accessed by the general public.
2. Unless otherwise noted, provide a minimum of three levels of access
   a. General User
   b. Non-Technical Employee
   c. AV Technician
3. Segregate the control functions to only allow authorized individuals access to more sophisticated control pages.
4. Provide a timeout feature to automatically return the control panel back to the default opening screen after 30 seconds of inactivity. After this reset, passwords must be reentered to return to a previous control page.

L. Presets
1. For systems that have different operating modes or configurations, provide the ability to store and recall preset combinations of system settings.
2. Provide a “Preset” page that permits a minimum of five presets to be recalled. Each button to include a label describing the function or configuration associated with that button.
3. Provide the ability for new presets to be stored over previous settings. New preset to be able to change the label to reflect the new or revised configuration.
4. When a preset has been recalled, the control page should indicate the active configuration.

3.5 LABELING OF EQUIPMENT

A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.

B. Provide logical and legible cable and wiring label permanently affixed for easy identification.

1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by Contractor. Add cable designation codes to system schematic drawings.
3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

3.6 ENGRAVING

A. Text font: 1/8 inch block sans serif characters unless noted otherwise.

B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.

C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.

D. Equipment label: black with white characters except where indicated.

3.7 COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:
   1. All products are installed in proper and safe manner according to manufacturer's instructions.
   2. Insulation and shrink tubing are present were required.
   3. Dust, debris, solder splatter, etc. is removed.
   4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
   5. Labeling has been provided.
   6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
   7. Products are neat, clean and unmarred and parts securely attached.
   8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.

B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards.
   1. Electronic devices are properly grounded.
   2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
   3. Verify each individual component is operating properly.
   4. Verify each individual component's performance meets the manufacturer's published performance for this unit.
   5. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.

C. Speaker Circuit Verification Test
   1. Measure the impedance of each speaker line leaving the equipment racks.
   2. For constant voltage systems measure the impedance at 100 (or 250) Hz, 1 KHz and 8 (or 10) KHz of each line leaving the equipment rack with the line disconnected from the driving source. For band limited devices, use a frequency appropriate for the operating range of the transducer.
   3. When documenting the results of these tests, include the calculated impedance based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedance.
   4. Include the results of the tests in the Project Record Manual.

D. Speaker Polarity Verification Test
   1. Use an electronic polarity checker, TEF-20, SYSID, SIM II, Smaart, or other similar device to test each loudspeaker. All speakers should have the same relative polarity.
   2. Follow manufacturer's recommendations in conducting the tests.
   3. Include the results of the tests in the Project Record Manual.

E. Audio Signal Paths
   1. Verify operation from each source device through all switching, amplification and distribution devices.

F. System Gain Adjustment
   1. Adjust each active device to have proper gain structure from the mixer output to the input of the amplifier.
   2. With all amplifiers turned off, connect a sine wave or pink noise generator to the input of the mixer. Using a RMS AC voltmeter with a dB scale, adjust the mixer to an output between -10 and 0 dBu. Once the level has been established, it should remain unchanged throughout the test. All equalizers should be set flat for this test.
   3. Follow the signal flow from the mixer to each subsequent component. Measure the input level and output level of each device at the point of connection to the device. The input level reading should differ no more than 0.25 dB from the level recorded for the preceding device. Diagnose and correct the wiring or equipment when any readings exceed this range.
   4. Adjust the output of each component to achieve the proper output level.
   5. Record the output levels of each device in the Project Record Manual.

G. Signal Delay Adjustment
   1. Adjust the delay to each subsystem to ensure proper synchronization between the main speakers and delayed speakers.
   2. Using a TEF 20, SYSID, Smaart, SIM II, or other acceptable time based measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal.
   3. Based on the arrival times measured, adjust the delay applied to the local speakers to synchronize them with the distant speakers. Repeat the test to verify the delay has been set to within 1 ms of the arrival of the distant signal. Once the precise delay time has been determined, provide an additional 10 ms of Haas effect delay to maintain directional orientation toward the original sound source.
   4. Continue to test and adjust each separate subsystem with a dedicated delay channel.
   5. Provide hard-copy printout of each delay adjustment showing first the arrival times with no delay set and then the result after the delay has been adjusted. Record the settings of each delay in the Project Record Manual.

H. Remote Input Verification Test
   1. Using a microphone or portable signal generator, connect to each microphone/line level receptacle throughout the facility.
   2. Verify that the receptacle under test appears at the correct input and is operating properly.
   3. In a similar manner, check all remote tielines and media related lines for correct wiring and labeling.

I. System Equalization
   1. Using a RTA, TEF 20, SYSID, or SMAART, equalize all loudspeaker systems to provide a suitable frequency response as follows:
      a. Speech Reinforcement Systems: flat response from 125 Hz to 2.5 KHz, with 2 dB roll off above.
      b. Program Reproduction Systems: flat response from 65 Hz to 8 KHz, with 2 dB roll off above.
   2. Verify system gain and amplifier levels.
   3. Provide program levels of at least 85 dB and speech reinforcement levels of at least 70 dB in the seating area without objectionable distortion, buzzes, or rattles.
   4. Provide hard copy printouts of the spectral response with the test data.

J. RFI and Parasitic Oscillation
   1. With systems operating check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.

K. Buzzes, Rattles and other Distortions
   1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 KHz and listen carefully for buzzes, rattles and other objectionable distortions.
   2. Correct the cause of the defect. If the cause is not from the system. Bring the cause to the attention of the GC, indicating cause and suggestive corrective actions.

L. Video Systems Test
   1. Projected images and screen must be plumb with respect to ceiling line.

M. Video System Tests. Verify performance of all video equipment, components and systems, as specified herein.
   1. Video (signal):
      a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 55 dB minimum.
      b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
      c. Frequency Response: Within plus to minus 0.5 dB to 4.2 MHz.
      d. Line and Field Tilt: 2% maximum.
      e. Differential Gain: 2% maximum.
      f. Differential Phase: 2 degrees maximum.

g. Frequency Response: DC to 4.2 MHz within plus or minus 0.5 dB.

N. Video Signal Paths
1. Verify operation from each source device through all switching, amplification and distribution devices.

O. Video Test Report shall include the following:
1. Test Failures and Notices
a. Sink Device EDID Test – Open items or failures shall not be accepted.
b. Cable Length Test – Open items or failures shall not be accepted.
c. HDCP KSV Limitations – Limitations shall not be accepted.
d. Cable Limitations - Limitations shall not be accepted.
e. EDID Limitations - Limitations shall not be accepted.
f. Cable Length Limits exceeded – Failing cables shall not be accepted.
2. Device Model Number, Serial Number, and Firmware Version for main chassis and each input and output card.
3. Device Model Number, Serial Number, and Firmware Version for connected transmitter and receiver devices.
4. EDID – Input Resolution and 3D support status for each input.
5. EDID – Supported Output Resolution and 3D support status for devices connected to each output.
6. EDID – Supported Audio formats for each input.
7. EDID – Supported Audio formats for devices connected to each output.

P. Control Systems
1. Verify operational functions of the control system and all interfaced devices.
2. Verify operational functionality of any wireless user devices.

3.8 CAT5E/CAT6 CABLE CERTIFICATION

A. General Field Test Requirements
1. All CAT5E/CAT6 cabling links installed as part of this scope shall be tested for the following, in accordance with the field test specifications defines in ANSI/TIA-568-C.2 “Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard.” This document will be referred to as the “Category 5e Standard”:
a. Wire Map
b. Length
c. Insertion Loss
d. NEXT loss
e. PS NEXT Loss
f. ACR-F Loss
g. PS ACR-F Loss
h. Return Loss
i. Propagation Loss
j. Delay Skew
2. The installed twisted-pair horizontal links shall be tested from terminated end point to terminated end point for compliance with the “Permanent Link” performance specification as defined in the Category 5e Standard.
3. One hundred percent of the installed cabling links must pass the requirements of the Category 5e standard mentioned above and as further detailed in Section B below. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with Section C below.
4. The test equipment (tester) shall comply with the accuracy requirements for level IIe field testers as defined in ANSI/TIA-1152. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 2 of ANSI/TIA-1152 (Table 2 in this TIA document also specifies the accuracy requirements for the channel configuration).
5. The RJ45 test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.
6. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
7. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. To ensure that

normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

8. The Pass or Fail condition of the link-under-test is determined by the results of the required individual tests (detailed in Section 4.2.2 of ANSI/TIA-1152). Any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass.
9. A Pass or Fail result for each parameter is determined by comparing the measured values with the specifies test limits for that parameter.

B. Performance Test Parameters

1. The test parameters are defined by the Category 5e Standard. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test, all measurements (at each frequency in the range from 1 MHz through 100 MHz) must meet or exceed the limit value determined in the above mentioned standard.
2. Wire Map - Shall report Pass if the wiring of each wire-pair from end to end is determined to be correct.
3. Length – The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for NVP. The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.
4. Insertion Loss (Attenuation) – Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through 100 MHz in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk Ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results of the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which the worst case value occurs, and the test limit value at this frequency.
5. NEXT Loss – Pair-to-pair near end crosstalk loss (abbreviated as NEXT loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations).This parameter is to be measured from 1 through 100 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT loss measurements shall not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

6. Table 1 – Maximum frequency step size as defined in ANSI/TIA-1152

Frequency Range (MHz)	Maximum Step size (MHz)
1 - 31.25	0.15
31.26 - 100	0.25

7. PS NEXT Loss – Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link under-test (a total of eight results). PS NEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 100 MHz and the step size may not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Maximum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS next. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
8. ACR-F Loss, pair to pair – Attenuation Crosstalk Ratio Far-end is calculated from the pair-to-pair FEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ACR-F Loss that must be evaluated and reported in the test results. ACR-F measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-F is to be measured 1 through 100 MHz and the maximum step size for FEXT loss measurements shall not exceed the maximum step size defined as the standard as in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst value for ACR-F. There wire pairs must be identified for the tests performed from each

end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

9. PS ACR-F Loss – Power Sum Attenuation Crosstalk Ratio Far-end is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs of the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
10. Return Loss – Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst value of Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
11. Propagation Delay – Propagation delay is the time required for the signal to travel from one of the links to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the wire pair with the worst propagation delay. The report shall include the propagation delay value measured as well as the test limit value.
12. Delay Skew – [as defined in the Category 5e Standard; Section 6.2.19] This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

C. Test Result Documentation
1. The test results/measurements shall be transferred into a Windows based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test and that these results cannot be modified at a later time.
2. The database for the completed job shall be stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports.
3. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:
   a. The identification of the link in accordance with the naming convention defined in the overall system documentation.
   b. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number.
   c. The date and time the test results were saved in the memory of the tester.
4. General information to be provided in the electronic data base with the test results information for each link:
   a. The identification of the customer site as specified by the end-user.
   b. The identification of the link in accordance with the naming convention defined in the overall system documentation.
   c. The overall Pass/Fail evaluation of the link-under-test
   d. The name of the test limit selected to execute the stored test results
   e. The cable type and value of NVP used for length calculations
   f. The date and time the test results were saved in the memory of the tester
   g. The brand name, model, and serial number of the tester.
   h. The identification of the tester interface
   i. The revision of the tester software and the revision of the test limits database in the tester
   j. The test results information must contain information on each of the required test parameters that are listed in Section B and as further detailed below under paragraph C5.
5.
6. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. The PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.
7.
8. The detailed test results data to be provided in the electronic database must contain the following information:

a. Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m330 and test limit value.
b. Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
c. Delay Skew: Identify the pair with the largest value for delay skew, the value measured in nanoseconds (ns) and the test limit value.
d. Insertion Loss (Attenuation): Minimum test results documentation as explained in Section B for the worst pair.
e. Return Loss: Minimum test results documentation as explained in Section B for the worst pair as measured from each end of the link.
f. NEXT, ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link.
g. PS NEXT and PS ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link.

3.9 FINAL OBSERVATION & TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final observation and test will be performed by the Owner or Owner's representative no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures will be performed on each System:
1. Observation of the methods and means employed to incorporate the System within the facility.
2. Verification of proper operation, from controlling devices to controlled devices.
3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor shall pay for additional time and expenses of the Owner at the standard rate in effect at that time.

3.10 TEST EQUIPMENT

A. Thirty days prior to start of testing, provide a list to the Owner of test equipment make, model numbers and calibration dates that will be used.

B. The following equipment shall be available on site for the entire test period through final system testing.
1. Sound Level Meter : ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
2. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz, ±1 dB (long-term average) at 0 dBm output. Stability: ±2 dB per day.
3. Dual-trace oscilloscope - 100 MHz bandwidth, 1 mV/cm sensitivity.
4. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 5k Hz. Measurement Range: 1 ohm to 100 kohms.
5. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±.5 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from –30 dBu to +10 dBu.
6. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
7. NTSC Test generator
8. Real time analyzer with LED or CRT display. The unit shall meet the filter requirements of ANSI S1.11 Class III for one third octave filters.
9. Video (analog) test generator capable of generating signal up to 1920 x 1200 with audio.

10. Video (digital) test generator capable of generating signal up to 1920 x 1200 with audio.
11. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

C. Provide three portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project. Include rechargeable batteries and recharger along with holster for wearing on belt. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

3.11 INSTRUCTION OF OWNER PERSONNEL

A. Provide 8 hours instruction to Owner designated personnel focusing on the use, operation and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative.

B. Video record all training sessions and compile a training video to be provided to the Owner on DVD.

C. Provide sign in sheet to document the attendee's presence.

D. If Contractor is not properly equipped to conduct Owner training on particular equipment, arrange for factory representatives of the equipment to be present to provide training at no additional cost to the Owner.

3.12 CLEANUP AND REPAIR

A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

END OF SECTION

SECTION 27 50 00

DISTRIBUTED COMMUNICATIONS AND MONITORING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section. Reference AV drawings for additional information.

B. The work of this section also includes:
1. Required licenses, insurance and permits including payment of charges and fees
2. Verification of dimensions and conditions at the job site
3. Preparation of submittal information
4. Pick-up of Owner Furnished Equipment (OFE) and incorporation into project if applicable.
5. Development and implementation of AV control system software code and control panel layouts, which shall become the property of the Owner
6. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction (AHJ)
7. Extension of electrical service, including ground, to equipment locations as required
8. Final tests and adjustments, written report, and documentation
9. Instruction of operating personnel
10. Provision of manuals
11. Maintenance services and warranty.

C. The drawings included with this specification convey general system concepts. The plans do not show complete and accurate building details. The Installer is responsible for making field measurements necessary to establish exact locations, relationships, and load capacities necessary for the installation of these systems.

1.2 RESPONSIBILITY

A. All materials, equipment, transportation, and labor necessary to achieve a complete and functionally working system as shown or inferred on the Drawings and in the Specifications. Supply accessories and minor equipment items (such as, but not limited to: power strips, adapters, connectors, mounting hardware, etc.) needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply a full working, tested, and calibrated system. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

C. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Architect.

D. Execute all work in accordance with the National Electrical Code (NEC), the National Electrical Safety Code, the Occupational Safety and Health Act (OSHA) and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect shall prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform Work.

E. A Ground point shall be provided in each equipment room or enclosure electrical panel. The installer shall be responsible for connecting ground points to all equipment in accordance with NEC Code, local codes and standards specified herein.

F. Power is provided for this work at locations shown on the electrical riser diagram and or other drawings / information in electrical drawings and specifications. Power shall be terminated to a panel within or near the equipment enclosure. The installer shall be responsible for termination and distribution of electrical power from the panel to the equipment as required.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 26: Electrical drawings and documentation.
   1. Conduit, wireways, floor boxes, wall boxes, pull boxes, junction boxes, AC power circuits and ground wiring.

B. Division 27: Structured Cabling System drawings and documentation.
   1. Category cabling, patch panels, connectors, faceplates/connecting hardware, and patch cords.

1.4 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
   1. American National Safety Institute (ANSI)
   2. American Society of Testing and Materials (ASTM)
   3. Electronics Industries Association (EIA)
   4. Federal Communications Commission (FCC)
   5. National Electrical Manufacturer's Association (NEMA)
   6. National Electrical Code (NEC)
   7. Underwriters Laboratories (UL)
   8. Occupational Safety and Health Administration (OSHA)
   9. Building Industry Consulting Service International (BICSI)
   10. Davis and Davis, Sound System Engineering (2nd Edition), Howard W. Sams, 1987
   11. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 1990
   12. AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009

1.5 DEFINITIONS

A. In addition to those Definitions of Division1, the following list of terms as used in this specification shall be defined as follows:
   1. Furnish - To purchase, procure, acquire, and deliver complete with related accessories.
   2. Install – To set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, items, or equipment supplied by Contractor.
   3. Provide – To furnish and install.

1.6 DESCRIPTIONS AND REQUIREMENTS

A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the systems.

B. Competition Gymnasium
   1. Intercom and Clock System
      a. The existing intercom and clock system shall be extended to the gymnasium addition, including new adjacent spaces. This system extension shall facilitate paging, emergency messaging, and campus time in these spaces.
      b. The system shall have priority control over AV systems through general purpose control signal provided by intercom devices. The control signal shall cause the AV system to mute in the event of an emergency.
      c. Emergency buttons located in the gym and lobby areas shall initiate hands-free, two-way communication with that area.
      d. Intercom devices with integrated LED displays shall display synchronized campus time.
      e. The intercom and clock system shall interconnect to the existing intercom data network using pathways and wire specified in 27 10 00.
      f. Software programming and control configuration shall be provided in accordance with district direction.

1.7 SUBMITTALS

A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated.

B. Supplementary submittal requirements:

1. Provide the following in one submission for approval within thirty days of issuance of Notice to Proceed (NTP) and prior to commencement of Work:
   a. Complete schedule of submittals.
   b. Chronological schedule of Work in bar chart form.
   c. Manufacturer's Data Sheets:
      (1) Provide a complete table of contents with the following information:
      (2) Project title.
      (3) Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
      (4) Date of submission.
      (5) Provide a list of and Manufacturer's data sheets on products to be incorporated with the Work. Arrange data sheets in the same order they appear in this specification. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
      (6) Submit manufacturer's product literature for each type of firestop material to be used. Literature shall include documentation of UL classifications or approved third party testing. Manufacturer's name and number for each part shall be included. Submit drawings of through penetrations, which include the system to be utilized for the firestopping application. Drawing shall indicate construction of wall or floor assembly; size, number and material of penetrating items; firestop system designation; required F-rating, T-rating and remarks.
      (7) Bind submittal in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.
      (8) Submissions that do not follow the format and configuration described above shall be returned without review.
   d. Shop Drawings:
      (1) Functional Diagrams/Schematics:
      (2) Detailed, redrawn wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and designators, and device designators for each system. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
      (3) Coordination Drawings:
      (4) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the audio and video system in relationship with other building components. Prepare drawings to an accurate scale of 1/8" =1'-0" or larger on suitable sized media.
      (5) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the Work including but not necessarily limited to the following:
      (6) Equipment housings
      (7) Wall mounted devices
      (8) Ceiling mounted devices
      (9) Equipment: Location of equipment within racks, consoles, or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
      (10) Patch panel(s): Layouts and designation (labeling) strips, including color schemes.
      (11) Full fabrication details of any custom enclosures and millwork indicating size, material, finish and openings for equipment.
      (12) Projector, loudspeaker, camera mounting details, include hardware types and load capacity.
      (13) Fabricated Plates and Panels: Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
      (14) Labeling: Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
      (15) Schedules: Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.
      (16) Consultant's project documents in electronic format shall not be supplied to the Contractor for their use as part of submittals.
      (17) Detail drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'–0".
      (18) Submissions that do not follow the format and configuration described above shall be returned without review.
      (19) Any other pertinent data which is necessary to provide the Work.

C. Resubmission requirements:
   1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
   2. Indicate all changes that have been made other than those requested.

1.8 CONTRACT CLOSE-OUT DOCUMENTS:

A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated, after substantial completion but prior to final observation:

B. Supplementary submittal requirements:
   1. Equipment Manuals:
      a. Manufacturer's owner/instruction manual for each type of Product by manufacturer and model or part number unless specified otherwise herein.
      b. Supply manufacturer’s serial numbers for each Product.
      c. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
      d. Separately bind list by manufacturer and model or part number of Products incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately.
      e. Test Reports: Recorded findings of Commissioning.
      f. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
         (1) This procedure should describe the operation of system capabilities.
         (2) Assume the intended reader of the manual to be technically inexperienced but unfamiliar with the components and the facility.
      g. Service Information, including service phone number(s) and hours; service schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
      h. Any other pertinent data generated during the Project or required for future service.
   2. Within three (3) weeks of final observation, submit the following:
      a. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
      b. Hardcopy full size set of Record drawings.
      c. Three (3) compact disc or DVD’s containing Record drawings in AutoCad editable DWG format and Adobe PDF format. Resolution to be sufficient to permit Owner’s technicians to be able to clearly read all notes and text on screen.
      d. One set of signed proof-of-training documents.
   3. Submittal Format:
      a. Record Drawings: Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1’–0”.
      b. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it shall reasonably clarify procedures, e.g., operational data in maintenance binding.
      c. Bind Project Record Manual in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.

C. Resubmission requirements:
   1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
   2. Indicate all changes that have been made other than those requested.

1.9 CUSTOM SOFTWARE

A. Introduction:
   1. Proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
   2. Contractor shall agree that 3rd party proprietary software provided with the system shall be subject to this agreement.
   3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor’s standard license agreement.

4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor-based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered “proprietary” software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership:
1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer’s use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
2. Except as expressly set forth in this agreement, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of Owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modifications, and Use:
1. Source code shall be available to Owner for a period of not less than 10 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of Owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right for Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

D. Warranties and Representations:
1. Contractor represents and warrants to Owner that:
   a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to Owner;
   b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners; and
   c. The software, as delivered as part of the system, shall not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.
2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system shall perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.
3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third-party intellectual property rights.

1.10 QUALITY ASSURANCE

A. Qualifications: Contractor to be experienced in the provision of systems similar in complexity to those required for this project; and meets the requirements listed below. Provide documentation at the time of bid to support these qualifications.
1. No less than three years’ experience with equipment and systems of the specified types.
2. Experience with at least three comparable scale projects within the last three years.
3. Be a franchised dealer and service facility for the manufacturer’s products furnished.
4. Maintain a fully staffed and equipped service facility with full time field technicians.
5. Have at least one supervisory on-site employee having completed and certified CTS-I by Infocomm.

6. At the request of the Owner, demonstrate that:
   a. Adequate plant and equipment are available to complete the work.
   b. Adequate staff with commensurate technical experience is available.

B. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
   1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
   2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
   3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

C. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the Architect.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Ship Products in its original container, to prevent damaging or entrance of foreign matter.

B. Handling and shipping in accordance with Manufacturer's recommendation.

C. Provide protective covering during construction of all installed devices, to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner, Products damaged during storage, handling or the course of construction.

1.12 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.13 WARRANTY

A. Warrant labor and equipment for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or equipment within the Warranty period without charge.

B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.

D. Provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Closeout Documents.

E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment (OFE). Coordinate observation visit with the Owner.

F. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products quantity is as required. If a quantity is given, provide at least the given amount. Some product listed may not be required to fulfill the obligations of the Work.

B. Equipment and materials shall be new and conform to applicable UL or ANSI provisions.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide Products complying with the specified manufacturer's published specifications.

D. Each major component of equipment shall have the manufacturer’s name, address, and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data that is die-stamped into the surface of the equipment shall be easily visible.

E. Take care during installation to prevent scratches, dents, chips, etc.

F. Paint ceiling and wall mounted speaker grilles and enclosures to match the surrounding ceiling or wall color as directed by Architect.

G. Audio XLR type connectors not part of manufactured equipment shall have gold plated contacts.

2.2 ACCEPTABLE MANUFACTURERS

A. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure.

B. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.

2.3 LOUDSPEAKERS

A. Type S1, Corridor / General Area Ceiling-Mounted Loudspeakers
   1. 2’ x 2’ lay-in ceiling tile IP intercom speaker
   2. Acceptable Product:
      a. Advanced Network Devices IPSCM

B. Type S2, Classroom Surface-Mounted Loudspeakers
   1. IP intercom speaker with LED display
   2. Acceptable Product to include:
      a. Advanced Network Devices IPSWD-P
      b. Advanced Network Devices AND-PIA-2 peripheral interface adapter card

C. Type S3, Double-Sided, Surface-Mounted Loudspeakers
   1. IP intercom speaker with LED display and flashers
   2. Acceptable Product:
      a. Advanced Network Devices IPCDS-RWB

D. Type S4, Gymnasium / Weight Room / Fitness Surface-Mounted Loudspeakers
   1. IP intercom speaker
   2. Acceptable Product to include:
      a. Advanced Network Devices IPSWS-SM-P
      b. Advanced Network Devices AND-PIA-2 peripheral interface adapter card

E. Type S5, Surface-Mounted Outdoor Loudspeakers
   1. IP intercom speaker
   2. Rated IP54 for moisture ingress
   3. Acceptable Product:
      a. Advanced Network Devices IPSWS-SM-O

F. Type S6, Smart Alert Strobe

1. IP strobe with control and audio pass-though
2. Acceptable Product:
   a. Advanced Network Devices IPSTROBE

G. Wire Cage Protector for Surface-Mount Loudspeaker (WIRE GUARD, Type 1)
   1. Acceptable Product:
      a. Wireguard G2017-WEB

2.4 CONTROL SYSTEM

A. Indoor Emergency Call Button (STI-1, Type 1)
   1. Acceptable Product:
      a. STI SS2224ZA-EN

B. Outdoor Emergency Call Button (STI-2, Type 1)
   1. Acceptable Product:
      a. SS2244ZA-EN

2.5 PLATES AND PANELS

A. Provide plates and panels and as described in Drawings. Engrave as shown on Drawings. Other Plates and Panels may be required to satisfy the requirements of the Work.

B. Custom panels shall be 1/8-inch thick nylon, standard EIA sizes, with coloring as directed by Architect unless noted otherwise.

C. Plate finish shall be coordinated with the Architect.

D. Panel, plate and label engraving shall be 1/8-inch block sans serif characters unless noted otherwise. On dark panels or pushbuttons, letters shall be white; on stainless steel or brushed natural aluminum pushbuttons, letters shall be black.

E. Custom and/or Engraved Panels
   1. Custom panels constructed of 1/8-inch brushed aluminum.
   2. Color as selected by Architect unless noted otherwise.
   3. Acceptable Product:
      a. RCI AVD series
      b. ProCo

2.6 CABLES & WIRING

A. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g. CMR, CMP, etc.)

B. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

C. Where cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.

D. Shielded cables shall have aluminum foil shield with drain wire.

E. Acceptable Product Manufacturers:
   1. Belden
   2. West Penn
   3. Windy City Wire

2.7 CONNECTORS

A. XLR Panel mount Connectors
   1. Provide panel mount XLR connectors with unified metal shell.
   2. RF-Protector connectors.
   3. Shell Color: Black.

4. Contacts: Gold.
5. Terminations: Solder.
6. Acceptable Product:
   a. Male Connectors: Neutrik NC*MD-L-1-BAG Series
   b. Female Connectors: Neutrik NC*FD-L-1-BAG Series

B. XLR Cable Connectors
1. Provide XLR cable connectors with die cast shell.
2. No-screw type assembly.
3. Chuck-type strain relief.
4. Shell Color: Black.
5. Contacts: Gold.
6. Terminations: Solder.
7. Acceptable Product:
   a. Male Connectors: Neutrik NC*MX-BAG Series
   b. Female Connectors: Neutrik NC*FX-BAG Series

C. ¼" Panel mount Connectors
1. Provide panel mount ¼" connectors with unified metal shell.
2. Shell Color: Black.
3. Contacts: Silver.
4. Terminations: Solder.
5. Acceptable Product:
   a. Female Connectors: Neutrik NJ3FP6C-BAG Series

D. ¼" Cable Connectors
1. Provide ¼" cable connectors with die cast shell.
2. No-screw type assembly.
3. Chuck-type strain relief.
4. Shell Color: Black.
5. Contacts: Nickel.
6. Terminations: Solder.
7. Acceptable Product:
   a. Male Connectors: Neutrik NP3C-BAG Series

E. BNC Cable Connectors
1. Provide cable mount BNC connectors.
2. Contacts: Brass or copper.
3. Terminations: Crimp.
4. Acceptable Product:
   a. Kings
   b. Amp
   c. Amphenol
   d. Canare
   e. Liberty

F. RCA Male Cable Connectors
1. Provide RCA cable connectors with die cast shell.
2. Shell Color: Silver.
3. Contacts: Silver.
4. Terminations: Solder.
5. Acceptable Product:
   a. Switchcraft 3502 Series
   b. Liberty

G. F Connector
1. Provide commercial style gold plated connector with integral sleeve for F6 Series, F11 Series, and F59 Headend cable.
2. Provide seal ring in all moisture intensive environments.
3. Install with manufacturer recommended compression tool.
4. Provide weatherized boots and seal covers for all antenna connections.
5. Verify connector cable type, size and construction with manufacturer.
6. Acceptable Product:
   a. Gilbert Engineering GF-US-6Q series, GF-US-11Q, and GF-US-59Q series respectively.

b. Gilbert Engineering Seal ring: G-SR-1/2

H. Other Connectors
1. As per manufacturers specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final Products.

B. The installation recommendations contained within ASDI and BICSI Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.

E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 INSTALLATION

A. Installation of cable and wiring
1. Cabling and Wiring:
a. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
b. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
c. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
d. Horizontal distribution cables shall be bundled in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
e. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
f. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
g. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.
h. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
i. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
j. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.
k. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors specifically intended for the type and class of cable being used. Where spade lugs are used, crimp properly with ratchet type tool.
l. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
m. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.
n. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed end connectors crimped

with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.

o. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.

p. Execute wiring in strict adherence to:

(1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co., 1990.

(2) Don Davis and Carolyn Davis. Appendix II, Recommended Wiring Practices. Sound System Engineering, 2nd Edition. Indianapolis: Howard W. Sams & Co., 1989.

(3) AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009

2. Equipment Housing Cabling and Wiring:

a. Lace, tie, or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire or cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag.

b. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.

c. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.

d. Provide plastic cable ties or Velcro straps to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.

e. Install with connections completely visible and labeled.

f. Provide termination resistors, if required, of 5 per cent tolerance; fully visible and not concealed.

B. Installation of connectors, plates & panels:

1. Install panel mounted connectors rigidly attached to panels, plumb and level.
2. Custom rack panels shall be 1/8-inch-thick aluminum, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.
3. Custom connector plates (speaker, microphone, etc) are typically stainless steel, unless otherwise noted or specified. However, verify plate finish with the Architect.
4. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
5. Other Plates and Panels may be required to satisfy the requirements of the Work.

C. Installation power and grounding:

1. Coordinate final connection of power and ground wiring to housings.
2. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
3. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
4. Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three-wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.
5. Replace manufacturers supplied 18-gauge IEC power cords with UL listed 18 gauge pre-molded 6”, 12”, 18”, or 24”. Use minimum length required. No looped or cable tied IEC power cords shall be permitted within the equipment rack.
6. Replace manufacturers supplied 14-gauge IEC power cords with UL listed 14 gauge pre-molded 18” or 36” for all equipment IEC capable. Use minimum length required and minimize looped or cable tied IEC power cords present in the equipment rack.

D. Installation of electronic equipment:

1. Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
2. Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
3. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures and mark their function and connections with engraved lamicoid labels.
4. Mount equipment plumb and level, firmly and safely held in place.

E. Installation of equipment housing:

1. Mount equipment in racks and consoles and fully wired and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks shall be fabricated on site and the reasons for the change.
2. Provide rear support for housing mounted equipment greater than 15 inches deep.

3. Provide blank panels to fill unused panel space within the equipment housing.
4. If Key door locks are required, key each housing type alike.
5. Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, CAT cable, and RF wiring on the right.
6. Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the end of testing.
7. If forced air active thermal management is used, provide ventilation blocking material on the front, sides, and rear of the equipment rack as needed. Reference Middle Atlantic Products “Controlling the Temperature Inside Equipment Racks”.
8. Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.
9. If equipment rack is not equipped with casters, provide two-inch-high wood base to isolate equipment rack from floor. Wood base should be capable of supporting the load.

F. Installation of loudspeakers:
1. Loudspeakers shall be mounted at the operating position in a safe, secure and permanent manner.
2. Rigging, mounting and support systems for loudspeakers shall be reviewed and certified by a registered Professional Engineer (PE) licensed to practice in the State in which the project is located. Documentation shall be included as a submittal item. Once the systems are installed, the PE shall physically inspect the methods and means used to verify compliance with the original design.
3. Paint speaker supports, and related hardware color as directed by Architect.
4. The aiming direction of all loudspeakers shall be adjustable by ±5 degrees vertically.
5. Structural support members to have a safety factor of at least five. Mounting hardware and wire rope to have a safety factor of eight. All fasteners to be graded and certified for use in the intended applications. Overhead suspension hardware shall comply with ASME B30.20 standards and all applicable local building and safety codes. Overhead suspension hardware must be of a type that includes product traceability controls.
6. Provide safety cable on all bracket mounted loudspeakers.
7. All loudspeakers located in ceiling tiles shall be located in the center of the tile unless noted otherwise.

3.3 FIRESTOP

A. A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.

C. Fire-stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed.

D. A drawing showing the proposed fire-stop system, stamped/embossed by the PE shall be provided to the Owner’s Technical Representative prior to installing the fire-stop system(s).

E. All fire-stop systems shall be installed in accordance with the manufacturer’s recommendations and shall be completely installed and available for observation by the local authorities prior to cable system acceptance.

3.4 LABELLING OF EQUIPMENT

A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.

B. Provide logical and legible cable and wiring label permanently affixed for easy identification.
1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by Contractor. Add cable designation codes to system schematic drawings.
3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

3.5 ENGRAVING

A. Text font: 1/8-inch block sans serif characters unless noted otherwise.

B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.

C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.

D. Equipment label: black with white characters except where indicated.

3.6 COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:
   1. All products are installed in proper and safe manner according to manufacturer's instructions.
   2. Insulation and shrink tubing are present were required.
   3. Dust, debris, solder splatter, etc. is removed.
   4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
   5. Labeling has been provided.
   6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
   7. Products are neat, clean and unmarred and parts securely attached.
   8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.

B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards.
   1. Electronic devices are properly grounded.
   2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
   3. Verify each individual component is operating properly.
   4. Verify each individual component's performance meets the manufacturer's published performance for this unit.
   5. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.

C. Speaker Circuit Verification Test
   1. Measure the impedance of each speaker line leaving the equipment racks.
   2. For constant voltage systems measure the impedance at 100 (or 250) Hz, 1 KHz and 8 (or 10) KHz of each line leaving the equipment rack with the line disconnected from the driving source. For band limited devices, use a frequency appropriate for the operating range of the transducer.
   3. When documenting the results of these tests, include the calculated impedance based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedance.
   4. Include the results of the tests in the Project Record Manual.

D. Speaker Polarity Verification Test
   1. Use an electronic polarity checker, TEF-20, SYSID, SIM II, Smaart, or other similar device to test each loudspeaker. All speakers should have the same relative polarity.
   2. Follow manufacturer's recommendations in conducting the tests.
   3. Include the results of the tests in the Project Record Manual.

E. Audio Signal Paths
   1. Verify operation from each source device through all switching, amplification and distribution devices.

F. System Gain Adjustment
   1. Adjust each active device to have proper gain structure from the mixer output to the input of the amplifier.
   2. With all amplifiers turned off, connect a sine wave or pink noise generator to the input of the mixer. Using a RMS AC voltmeter with a dB scale, adjust the mixer to an output between -10 and 0 dBu. Once the level has been established, it should remain unchanged throughout the test. All equalizers should be set flat for this test.
   3. Follow the signal flow from the mixer to each subsequent component. Measure the input level and output level of each device at the point of connection to the device. The input level reading should differ no more

than 0.25 dB from the level recorded for the preceding device. Diagnose and correct the wiring or equipment when any readings exceed this range.
4. Adjust the output of each component to achieve the proper output level.
5. Record the output levels of each device in the Project Record Manual.

G. Signal Delay Adjustment
1. Adjust the delay to each subsystem to ensure proper synchronization between the main speakers and delayed speakers.
2. Using a TEF 20, SYSID, Smaart, SIM II, or other acceptable time-based measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal.
3. Based on the arrival times measured, adjust the delay applied to the local speakers to synchronize them with the distant speakers. Repeat the test to verify the delay has been set to within 1 ms of the arrival of the distant signal. Once the precise delay time has been determined, provide an additional 10 ms of Haas effect delay to maintain directional orientation toward the original sound source.
4. Continue to test and adjust each separate subsystem with a dedicated delay channel.
5. Provide hard-copy printout of each delay adjustment showing first the arrival times with no delay set and then the result after the delay has been adjusted. Record the settings of each delay in the Project Record Manual.

H. Remote Input Verification Test
1. Using a microphone or portable signal generator, connect to each microphone/line level receptacle throughout the facility.
2. Verify that the receptacle under test appears at the correct input and is operating properly.
3. In a similar manner, check all remote tie lines and media related lines for correct wiring and labeling.

I. System Equalization
1. Using a RTA, TEF 20, SYSID, or SMAART, equalize all loudspeaker systems to provide a suitable frequency response as follows:
a. Speech Reinforcement Systems: flat response from 125 Hz to 2.5 KHz, with 2 dB roll off above.
b. Program Reproduction Systems: flat response from 65 Hz to 8 KHz, with 2 dB roll off above.
2. Verify system gain and amplifier levels.
3. Provide program levels of at least 85 dB and speech reinforcement levels of at least 70 dB in the seating area without objectionable distortion, buzzes, or rattles.
4. Provide hard copy printouts of the spectral response with the test data.

J. RFI and Parasitic Oscillation
1. With systems operating check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.

K. Buzzes, Rattles and other Distortions
1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 KHz and listen carefully for buzzes, rattles and other objectionable distortions.
2. Correct the cause of the defect. If the cause is not from the system. Bring the cause to the attention of the GC, indicating cause and suggestive corrective actions.

L. Control Systems
1. Verify operational functions of the control system and all interfaced devices.
2. Verify operational functionality of any wireless user devices.

3.7 CATEGORY CABLE CERTIFICATION

A. General
1. Reference section 27 10 00 for all category cable requirements.

3.8 FINAL OBSERVATION AND TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final observation and test shall be performed by the Owner or Owner's representative no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures shall be performed on each System:
   1. Observation of the methods and means employed to incorporate the System within the facility.
   2. Verification of proper operation, from controlling devices to controlled devices.
   3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
   4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor shall pay for additional time and expenses of the Owner at the standard rate in effect at that time.

3.9 TEST EQUIPMENT

A. Thirty days prior to start of testing, provide a list to the Owner of test equipment make, model numbers and calibration dates that shall be used.

B. The following equipment list is provided to define the expected test equipment type for permanent links. The test equipment is to be available for the entire test period through final system testing.
   1. Fluke – Versiv Cable Certifier
      a. The most current software, firmware, and appropriate launch cords must be used.
   2. Sound Level Meter: ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
   3. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz, ±1 dB (long-term average) at 0 dBm output. Stability: ±2 dB per day.
   4. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 5k Hz. Measurement Range: 1 ohm to 100 kohms.
   5. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±.5 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from –30 dBu to +10 dBu.
   6. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
   7. NTSC Test generator
   8. Real time analyzer with LED or CRT display. The unit shall meet the filter requirements of ANSI S1.11 Class III for one third octave filters.
   9. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

C. Provide three portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project. Include rechargeable batteries and recharger along with holster for wearing on belt. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

3.10 INSTRUCTION OF OWNER PERSONNEL

A. Provide training in accordance with Division 1 to Owner designated personnel focusing on the use, operation and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner’s Representative.

B. Video record all training sessions and compile a training video to be provided to the Owner on DVD.

C. Provide sign in sheet to document the attendee’s presence.

D. If Contractor is not properly equipped to conduct Owner training on particular equipment, arrange for factory representatives of the equipment to be present to provide training at no additional cost to the Owner.

3.11 CLEANUP AND REPAIR

A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

END OF SECTION

SECTION 28 05 00

COMMON WORK RESULTS FOR ELECTRONIC SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. See individual related documents for summary of work for each section.

B. Work will consist of providing and installing prescribed systems and equipment, in accordance with the Owner's directives and needs. Contractor will design, install and configure systems to provide the exact function described herein, when specified, and will be held to the operational criteria. Contractor will be responsible for providing and installing a complete and fully operational system, with the intended features and capabilities, whether or not all required parts, components, systems or accessories are specified in the construction documents. Contractor will provide all required parts, components, systems, materials, accessories, and programming needed for a complete and working system, without additional cost to Owner.

C. Although such work is not specifically indicated, provide and install supplementary or miscellaneous items, appurtenances and devices incidental to, or necessary for, a sound, secure and complete installation.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections will apply to this section and will be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications. Where the Project General Conditions conflict with the requirements defined herein, the more stringent of the requirements and the Project General Conditions will prevail.

B. This Specification Section incorporates general requirements for the following security sections.
   1. 28 05 13 Conductors and Cables for Electronic Security
   2. 28 10 00 Access Control
   3. 28 15 15 Direct Interface Integrated Locking Devices
   4. 28 15 23 Intercom Entry Systems
   5. 28 20 00 Video Surveillance
   6. 28 30 00 Intrusion Detection
   7. 28 33 00 Security Monitoring and Control

1.3 RELATED WORK NOT IN THIS SECTION

A. General and specific provisions of these Specifications apply to the work specified in this Section, as well as:
   1. Mockups
   2. Division 08 Door Hardware
   3. Division 26 Electrical
   4. Division 27 Structured Cabling
   5. Division 07 Firestopping

1.4 DEFINITIONS

A. Owner's Representative: The representative or representatives appointed by the Owner responsible for project construction supervision.

B. Provide: To purchase, deliver to site and furnish all labor and material as necessary for a complete and operational system as specified herein.

C. Contractor: The Party contracted by the Owner or their designated representative to Provide Work specified herein.

D. Contract Documents: Documents used to specify the Work and govern the work of Contractor in their entirety or in part.

E. Work: The entire completed construction of the individual parts of the project as specified herein.

F. Local Authority Having Jurisdiction: The local governmental entity responsible for adopting and enforcing all code requirements at the location Work is being performed.

G. Project General Conditions: Include all relevant contractual requirements for the Project to include Division 1 General Conditions as well as Owner-provided and established contractual provisions.

H. Security Subsystem Specifications: Those specifications that apply to security subsystems for which these General Security Requirements apply.

I. The following are definitions utilized within this specification section:
   1. (ACS).Access Control System.
   2. (VMS).Video Management System.
   3. (GUI).Graphical User Interface.
   4. (IP).Internet Protocol.
   5. (KVM).Keyboard Video Mouse.
   6. (UI).User Interface.

1.5 SOFTWARE AND NETWORK

A. Custom Software Overview:
   1. Integration of the Division 28 sections, including programming and development of any custom software that may be required of this section, is the responsibility of the contractor. It is the responsibility of the contractor(s) to work with the Owner and manufacturers to develop these integrations. When custom modules are required, it will be the responsibility of the contractor to coordinate with manufacturers for API's and SDK's in order to have the programs written.
      a. Custom software programming must be contracted to the manufacturer to write, however, the expense of the development will be the responsibility of this section.
      b. Any custom software developed for this project shall be maintained for changes to all systems integrated for a minimum of five years after completion of project.

1.6 REFERENCES

A. American National Standards Institute (ANSI)

B. Electronic Industry Association (EIA)

C. National Electric Code (NEC)

D. Telecommunications Industry Association (TIA)

E. National Electrical Manufacturer's Association (NEMA)

F. Underwriters Laboratories (UL)

G. National Fire Protection Association (NFPA)

H. Federal Communications Commission (FCC)

I. Institute of Electrical and Electronics Engineers (IEEE)

J. Occupational and Safety Health Administration (OSHEA)

K. Open Network Video Interface (ONVIF)

1.7 APPLICABLE CODES AND STANDARDS

A. The Contractor will ensure that all Work provided under this section will meet the minimum requirements of all applicable codes and standards, as determined by the LAHJ.

B. Where the requirements of this section exceed the minimum requirements of the LAHJ, this section will govern. Where codes conflict with the Contract Documents, codes will govern. Where any applicable codes and standards conflict between themselves, the more stringent will apply.

C. Nothing in this section will relieve Contractor from the responsibility for compliance with all applicable codes, standards or specifications which are generally recognized to be applicable to the Work specified herein.

D. Contractor will make application for, and obtain, any and all permits required by federal, state, county, city or other LAHJ over the work. In the event that inspections are required, it will be the responsibility of Contractor to schedule and ensure the completion of said inspections and to ensure that all necessary certificates are issued, obtained, and delivered to the Owner.

E. Within this Section and the Security Subsystem Specifications, reference is made to United States-based standards, codes and legislation. For projects outside the United States, the corresponding local codes, standards and legislation will apply, except where local requirements are less stringent than those proscribed within the referenced United States requirements. In these cases, the referenced United States requirements will apply.

1.8 SUBMITTALS

A. General:
   1. Coordination is required with the Contractor for complete shop drawings and submittal packages.
   2. Provide simultaneously the following for approval thirty days after issuance of notice to proceed and prior to commencement of work:
      a. Complete schedule of submittals.
      b. Chronological schedule of work in bar chart form.
   3. Submittal format:
      a. Provide a unique control number in consecutive order.
      b. Provide a complete table of contents with the following information:
         1) Project title and number.
         2) Submittal number. In the case of a re-submittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
      c. Date of submission.
      d. Referenced addendum or change order number as applicable.
      e. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable:
         1) Index by the data in specification order, manufacturer and model or part number unless specified otherwise herein.
      f. Each submission page stamped with Contractor’s certification stamp, initialed or signed certifying:
         1) Review, approval and acceptance of submission.
         2) Certification of product compliance to specification.
         3) Verification product may be incorporated within the work.
      g. Arrange product data list in specification order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer’s data sheets, arranged in the same order. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
      h. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1’–0”. Provide one reproducible and two bound prints of which the processed reproducible will be returned to Contractor, additional prints will not be reviewed or returned.
      i. Submittal documents shall be computer generated. Free-hand sketches or reproductions of Contract Documents will not be acceptable and contractor will be deemed nonresponsive.

B. Samples as required within these specifications:
   1. Provide cable samples of all cables specified in this division:
      a. Each cable sample will have the rating as required by the NEC printed on the jacket by the manufacturer:
         1) Identify each sample with the specification section it is being submitted for.
   2. Provide letter from manufacture with estimated lead time for each type of cable.

C. Prefabrication as required within these specifications:
   1. Prefabrication submittals will be submitted in English in addition to the local language. Submittals not translated to English will be rejected without review.
   2. Prefabrication submittals will completely demonstrate the Contractor’s understanding and interpretation of the systems, equipment, devices, and components being installed. Prefabrication submittals will consist of shop drawings and product data as defined herein. Submittals will clearly show materials, dimensions, operational features, durability, technical limitations and requirements, and all other information required for a complete and thorough review.

3. Acceptance of prefabrication submittals by the Owner's Representative will not relieve Contractor from any responsibility to Provide Work as defined in the Contract Documents. No portion of the Work will commence until the Owner's Representative has approved the prefabrication submittals in writing.
4. All prefabrication submittals will be submitted by Contractor in their complete form. Partial submittals will not be considered.

D. Action Submittal:
   1. This submittal is intended to be used when a substitution is being requested.
   2. Product Data:
      a. Provide a list of, and manufacturer's data sheets on product to be incorporated within the work:
         1) Manufacturer's product technical datasheet for each product in sufficient detail to facilitate proper evaluation to the product's suitability for incorporation within the work. Where multiple products are shown on the same datasheet, the product intended to be used shall be identified in a manner that can be photocopied in black and white.
         2) Manufacturer's wiring diagram for electrically actuated units in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the work.
         3) Organize the data sheets in the order of the specification.
   3. Comparison Matrix:
      a. Provide a Matrix showing the features of the specified product in one column with the next column depicting how the proposed item's features compared.
      b. Highlight any item that does not exceed the specification or feature of the specified device.
      c. Provide documentation showing the device being substituted is on the approved devices list:
         1) If generic ONVIF driver is used the contractor will show that the substituted product will have the same quality and features as the native driver for the originally specified product.
   4. Shop Drawings:
      a. See below
   5. Samples if required by owner or architect.

E. Informative Submittal:
   1. This submittal is intended to be used when using specified equipment.
   2. Product Data:
      a. Provide a list of and the manufacturer's data sheets on product to be incorporated within the work:
         1) Manufacturer's product technical datasheet for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the work. Where multiple products are shown on the same datasheet the product intended to be used shall be identified in a manner that can be photocopied in black and white.
         2) Manufacturer's wiring diagram for electrically actuated units in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the work.
         3) Organize the data sheets in the order of the specification.
   3. Shop Drawings:
      a. See below.
   4. Samples if required by owner or architect.

F. Shop drawings:
   1. Shop drawings will be computer generated in AutoCAD® Revit. Coordinate version with owner's representative. Drawings will be precisely scaled. Free-hand sketches or reproductions of Contract Documents will not be acceptable and contractor will be deemed nonresponsive.
   2. PDF prints will be produced of all sheets and organized following the architectural numbering format.
   3. Coordinate with the Owner's Representative to obtain architectural model/backgrounds in electronic or hardcopy format for use in the shop drawings.
   4. Shop drawings will consist, at a minimum, of the following:
      a. Floor plan drawings indicating the location of all security devices as well as all wire runs and designations.
      b. Plans, elevations and details indicating dimensions, gauges, reinforcement, anchorage, and other installation details for each device as required.
      c. System point-to-point diagram indicating the inter-relationship of all security system peripheral devices, control panels, software / monitoring workstations, and other components as necessary for a complete and operational system.
      d. Typical wiring diagrams for each system peripheral device.
      e. Specific wiring diagrams for each system control panel, power supply, video recorder or other device or equipment that controls or communicates with multiple peripheral devices.
      f. Fabrication shop drawings for all custom equipment.
      g. Installation: Special details depicting methods and means specific to each product, assembly and each product manufacturer's recommended installation methods and means.

h. Equipment: Location of equipment, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations. This will include equipment closet layouts, power inserters, camera power supplies etc.
i. Camera mounting details for each camera position. Each mounting detail will contain sufficient scaled detail to indicate the entire coverage area and attachments.
j. Control software screens. Provide color printouts of screen layout for camera, floor layouts and controls. This requirement is to be coordinated with the GUI development process.
k. Fabricated plates and panels: Provide complete drawings on custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
l. Labeling: Representative equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and descriptor and designator schedule.
m. Any other pertinent data generated which is necessary to provide the Work.
n. Seek the services of a state licensed structural engineer to stamp and approve mounting details of cameras mounted on any location requiring a foundation, dedicated poles (such as outside locations), or where the objects are mounted over seating areas.
o. Copying contract documents and returning them as shop drawings will be considered as nonresponsive.

G. Record Documents:
1. Submit four bound originals of the following Project Record Manual information after substantial completion and prior to final inspection:
a. Product Data: Product actually incorporated within the Work:
1) Manufacturer's data for each type of product conforming to the scheme specified herein.
2) Include manufacturer’s serial numbers within the list of product.
3) All product data for the Project will be tabulated into a comprehensive list of equipment to be provided for the Project, including quantities, manufacturer names, model numbers, description and any applicable options. The product data submittal will be of sufficient detail that the Owner’s Representative may readily identify the equipment and materials proposed.
b. Provide all product data in hard copy organized in three (3) ring binders as well as three (3) in electronic formats on CD or USB thumb drive. Bind Project Record Manual in titled three ring D style binders sized for 150 percent of the material in general conditions sections described previously as part of this specification. Maximum size: three inch ring. Use multiple volumes if necessary:
1) Product data will consist, at a minimum, of the following:
a) Product data sheets for each piece of equipment included in the project identifying the following:
i) Materials and Fabrication.
ii) Tolerances.
iii) Power and environmental / HVAC requirements.
iv) Special criteria related to particular systems and components.
v) Specifically and clearly mark items submitted where multiple items and options occur on a sheet.
c. Identify all Parts and Components by name and manufacturer's number:
1) Manufacturers’ brochures for each of the system components included. Contractor will submit original brochures; copies will not be acceptable. Where information is in color, all copies will be provided in color.
2) Schedules will independently identify each piece of equipment, component and device provided for the project including project name/number reference, product name and number, installation location and conductor/cable identifications that devices are connected to.
d. Reference both manufacturer and construction document identification.
e. For information submitted in a schedule, include information independently in an organized and consistent format.
f. Provide programming point information within the schedules:
1) At the request of the Owner’s Representative and as identified in Security Subsystem Specifications, submit color samples for specific pieces of equipment.
2) Where test data is required by the Security Subsystem Specifications or Project General Conditions, all tests must be specific to products supplied specific for this project.
3) Certificates and Testing Information:
a) Provide a manufacturer’s certificate certifying that Products meet or exceed specified requirements.
b) Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency.
4) The Owner’s Representative will have the right to request additional information as required for a proper review of the submittal information.

5) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
6) Manufacturer's wiring diagram for each type of product actually incorporated.
7) Manufacturer's maintenance and care instructions.

g. Record drawings: Final rendition of submission depicting what is actually incorporated within the Work.
h. Test Reports: Recorded findings of Contractor's Commissioning.
i. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
   1) This procedure should describe the operation of system capabilities.
   2) Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
j. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
k. Any other pertinent data generated during the Project or required for future service.
l. Segregate documents within the three separate bindings containing data relevant to operational, maintenance and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.
m. Provide the same layout in PDF form within the electronic storage media listed above. The bindings would be electronic folders. All PDF files must be flattened so that any notes or comments are not able to be moved accidently when selected.

1.9 CLOSEOUT SUBMITTAL

A. Copy of Maintenance contracts.

B. Operation and Maintenance Manual and Schedule.

C. Bonds.

D. Warranty Documentation.

E. Record Documentation.

F. Copy of software.

1.10 MAINTENANCE MATERIAL SUBMITTAL

A. Copy of Maintenance contracts.

B. Operation and Maintenance Manual and Schedule.

1.11 RESUBMITTAL

A. Resubmission Requirements:
   1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.

      a. Indicate any changes that have been made other than those requested. Identify each change or correction with the appropriate delta identifier and cloud the change.

B. Replace at no expense to Owner, product damaged during storage, handling, or the course of construction.

1.12 SITE DOCUMENTATION

A. Contractor will maintain up-to-date record drawings on site for inspection by the Owner's Representative. Each change to the original approved submittal data and deviation from the Contract Documents will be indicated on the record drawings. Contractor will ensure that the record drawings are protected against soiling, tears, or other damage or defacement. At the conclusion of the Project the Contractor will incorporate all changes on the record drawings into electronic format and will submit the completed set as As-built documentation as defined in the section titled "Record Documentation" herein.

1.13 QUALITY ASSURANCE

A. Contractor will have a minimum of five (5) years of experience in the design, installation, and commissioning of projects of a similar nature. Contractor will provide evidence of completion of at least two (2) projects of a similar size to that specified herein that have been in operation a minimum of one year.

B. The Contractor will be equipped to support the Project from a local field office. The office will offer twenty-four (24) hour emergency service with a maximum response time of four (4) hours. The Contractor will have an in-depth understanding of all local codes and requirements for the area that the Project is located in.

C. Contractor will be an authorized dealer of each of the major access control, intrusion detection, and video product lines specified in the associated specification sections. Contractor will provide written proof of dealership status along with bid.

D. In addition to experience requirements stated, Owner's Representative reserves the right to require:
   1. Site visit to at least two facilities where installations have occurred and are in use.
   2. Owner approval.
   3. Surety bond backed warranty.
   4. Proof that contractor or bidder is familiar with installations to be made.
   5. Background information on prior installations, including the following information:
      a. Owner, Architect, and contractor contacts
      b. Names
      c. Phone numbers
      d. Addresses

1.14 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products in accordance with manufacturer's recommendations, so as to minimize the opportunity for damage, deterioration, or loss.

B. The Owner assumes no liability or responsibility for loss by theft, vandalism, burglary of material or equipment stored on site.

C. Deliver all equipment and material to the site in the manufacturer's original sealed packaging. Packaging is to provide factory identification of items contained within the packaging, and protection until the items or materials are installed. Inspect all equipment and material upon delivery to ensure that they are free from damage and in accordance with the Contract Documents.

D. Acceptance of the products constitutes the contractor's acknowledgment that products or materials are satisfactory for use.

E. Store products in their original packaging until installation. Protect from spoilage, moisture, all weather related conditions, corrosion, breakage, or other damaging elements. Store in conditions that will insure all required manufacturer's environmental criteria are maintained until use of material or products.

1.15 TECHNICAL SYSTEMS SOFTWARE LICENSE

A. Introduction:
   1. All proprietary software provided for the Technical Systems will be subject to this software license agreement between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
   2. Contractor will agree that 3rd party (e.g. manufacturer's) proprietary software provided with the system will be subject to this agreement.
   3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and will supersede any standard manufacturer or Contractor's standard license agreement.
   4. Proprietary software will be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
   5. For sake of this agreement, MS Windows® will not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it will be deemed proprietary.

B. License Grant and Ownership:
   1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software will mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
   2. Except as expressly set forth in this paragraph, the Contractor will at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system will be delivered to Owner for the sole benefit of Owner.
   3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property will remain the exclusive property of Owner and will not be used by Contractor for any purposes other than those associated with delivery of the system.
   4. Contractor shall provide all licenses or modules to make the system fully functional system.

C. Copies, Modification and Use
   1. Source code will be available to Owner for a period of not less than 10 years.
   2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software will remain within the direct control of Owner and its representatives.
   3. Owner may make modifications to the source code version of the software, if, and only if, the results of all such modifications are applied solely to the system. In no way does this Software License confer any right in Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
   4. All express or implied warranties relating to the software will be deemed null and void in case of any modification to the software made by any party other than Contractor.
   5. During the life of the system (defined as a period of not less than 10 years and not more than 15 years), the Contractor will provide software updates in accordance with all necessary support requirements to maintain the system. This will include a commitment to provide appropriate patches, fixes, and interface updates as necessary to maintain the operability and security of the system at a level commensurate with the original system:
      a. In the event that computer and or processor hardware refinements and updates are necessary to support software updates 5 years after substantial completion, said hardware will be provided to Owner at negotiated terms between the Contractor and the Owner.
      b. Labor will be in accordance with change order rates of the original contract, as adjusted for inflation in accordance with conditions and limitations of the general contractor or U.S. Bureau of Labor Statistics' Consumer Price Index (CPI).
   6. All hardware supplied will support software updates for a period of not less than 5 years following substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS, EQUIPMENT AND DEVICES

A. Herein and within the related Sections of Work identified herein, performance requirements and other specifications related to equipment to be provided as part of this Project are listed. Contractor will refer to the identified product or a known equal for acceptable manufacturers of equipment.

B. Or approved equal basis:
   1. The products are listed or are on an approved equal basis. The known equals to the products specified are listed in each section.
   2. Substitute products not listed in this section may be submitted for approval during the question and answer period of the bidding phase. See substitution requirements in this section.
   3. Substitution approvals will be based on the complete functionality, integration, operation, and user interface as it compares to the specified product(s).
   4. Products not approved prior to the bidding phase will be deemed non-responsive.

C. Provide products of types, materials, sizes, capacities and electrical characteristics as indicated. Products will meet the following requirements:
   1. Design and construction will be as recommended by manufacturer and as required for installation.
   2. Provide manufacture's standard product as indicated by published product information.

D. Where special power treatment is required, such as filtering or spike elimination that may be required for proper operation of the system, Contractor will provide as part of the system.

E. Acceptable product will be as indicated in each section. All products will meet the following requirements:
   1. Manufacturer will have a minimum of 5 years' experience producing the specific types of products to be used.
   2. All like equipment, components and devices will be by one manufacturer where possible unless the major component manufacturer does not provide a specific device, (example; 180° or 360° camera).
   3. Where different manufacturers must be provided, all products will be totally compatible.

F. Where specific model numbers are not provided for a specific manufacturer, information is provided to indicate the level of quality to be met by other approved manufacturers:
   1. Systems provided are to be of factory designed, independently tested, published components; coordinated, designed and interfaced to perform as one unitized system.
   2. Include all required wire, cable, fittings and miscellaneous accessories.
   3. Unless specifically noted, components and system logic will be provided through microprocessors and pre-designed cards.
   4. Provide low voltage components and devices where possible.
   5. Provide only systems designed for continuous 24-hour 7 days a week operation.

2.2 FABRICATION

A. Electronic Equipment and Components:
   1. To the greatest extent possible, provide standard equipment and components, designed to operate as complete coordinated systems capable of interfacing with all related systems required for the work.
   2. Where custom fabricated and integrated systems or components, such as vehicular pedestals, are required or indicated, provide compatible components and complete system to attain performance and operational capabilities intended.

B. Factory finish all components:
   1. Where selected color is not specifically identified in contract documents, submit sample materials finished with actual colors and textures. Contractor will submit for approval the full range of colors and textures for approval by the Owner's Representative.
   2. See Security Subsystem Sections for specific finishes.

C. Provide factory-fabricated wire of the size, rating, material and type as indicated for each service. Where not indicated, provide proper selection as required to comply with installation requirements and with local standards adopted by the LAHJ.

PART 3 - EXECUTION

3.1 EXAMINATION AND SITE PREPARATION

   a. Prior to bidding, examine the project (if under construction) for nature, scope and intent of all work to be performed and notify Owner's Representative in writing of any conditions determined to be detrimental to proper completion of the Work.

A. Submission of a bid/proposal will constitute that examination has been made, and any difficulties foreseen identified and noted. Any claims for labor, work, materials or equipment for difficulties encountered which should have been foreseen, will not be recognized; and will be taken care of by the contractor at no additional cost to the Owner.

B. Do not proceed with Work until all unsatisfactory conditions have been corrected.

C. Prior to installation of systems components and devices, verify that all required preparations have properly occurred and that substrates are acceptable for installation:
   1. Verify all rough-ins and field dimensions.
   2. Report any discrepancies, unsatisfactory conditions and prevailing conditions that will adversely affect satisfactory execution of work for systems included under this specification section.
      a. Do not proceed with work until unsatisfactory conditions have been corrected.
      b. Owner's Representative reserves the right to review proposed methods of direction, reject proposed methods and have the installation done in a satisfactory method at the Contractor's cost.
      c. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install all system components in accordance with manufacturer's written instructions, in compliance with all applicable codes and standards and in accordance with recognized industry practices.

B. Ensure that all equipment is properly installed to avoid mechanical stresses, twisting or misalignment of equipment that may be exerted by clamps, supports and cabling.

C. Thoroughly clean all areas and spaces where work is performed or used as access to work. Completely remove all paints, mortars, oils or other residues and otherwise restore all surfaces to their original condition. Upon completion of the work, remove refuse and rubbish from and about areas of work. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

D. Grounding:
   1. Provide equipment grounding connections for all systems as indicated herein and in the Contract Documents. Ensure and demonstrate that resistance to solid earth for signals is less than or equal to three (3) ohms.
   2. In no event will the AC neutral conductor, either in a power panel or in receptacle outlets be used for a reference ground.
   3. Ground all equipment in accordance with the manufacturers' requirements. Contractor will be responsible for diagnosis and correction of all problems related to improper grounding, including that which causes damage to equipment.

E. All equipment will be installed square and plumb. Ensure that all equipment is clean and free of paint and other foreign materials.

F. All installation practices will adhere to all applicable regulations, codes, ordinances, and standards as required by the LAHJ.

G. Clearly identify points of connection for wiring from building power system to work of this section, and requirements for connection to materials and equipment supplied under other Sections of Work.

H. Provide all transformers, relays and other accessories as required for a complete and operational system as defined herein and as required by the Security Subsystem Specifications. Furnish and install all fastenings, plates and other incidental items required for complete and operational installation.

I. Labeling: All cables will be permanently labeled at their point of termination with mechanically produced labels. Label text will match that indicated on the record drawings.

J. Contractor will ensure that all equipment installations and mounting are in strict accordance with requirements for applicable seismic classification.

K. Prior to installation, ensure that each installation area meets the following conditions:
   1. All wet work is completed.
   2. Area is dust free.
   3. All work is completed in regard to painting.

L. Anchor components securely in place, plumb, level, and accurately aligned. Provide separators and isolators to prevent corrosion and electrolytic deterioration.

M. Protect installed equipment from damage and spoilage.

N. Touch up minor scratches and abrasions with manufacturer's touch-up paint as necessary.

O. Double-sided foam tape will not be used to secure any terminal boxes, relay bases or circuit boards, etc.

P. All device mounting will be of a permanent nature.

Q. During installation, care will be exercised at all times to protect Owner property.

3.3 COORDINATION

A. Coordinate all Work to be performed with the General Contractor as necessary for smooth and expedient completion. Ensure critical path to completion where Work specified herein in dependent upon completion of Work by other trades or by Owner. Coordinate with other trades to avoid conflicts where Work in a certain area requires exclusive use of the area for the duration of the Work.

B. Coordinate arrangement and quantity of security-related assemblies with ceiling space configuration and with other components occupying ceiling space, including structural members, ductwork, electrical raceways, lighting fixtures and other items.

C. Furnish any inserts required for building into concrete, masonry, and other work, to support and attach work of this section. Furnish in ample time to comply with schedule of work into which inserts are built.

3.4 SYSTEM STARTUP

A. Subsequent to installation, clean each system component of dirt, dust, oils and other residues incurred from project activities and prepare the system for activation by following each manufacturer's recommended procedures for adjustment, alignment and synchronization.

B. Program the system in accordance with the Owner's instructions and with the requirements of this Section.

3.5 OWNER PERSONNEL TRAINING

A. Contractor will provide on-site training by factory personnel in the operation, setup and administration of all systems and major components installed.

B. Provide a detailed training schedule to the Owner no later than 30 days prior to system completion or the date of Owner's beneficial use of system, whichever comes sooner.

C. Operator Training: Instruct operating staff in proper operation, including hands-on training. Operator training will meet the following requirements:
   1. Will cover the operations for each system installed.
   2. Training sessions will be provided to supervisors, staff utilizing systems and equipment provided under this section, maintenance personnel and any other personnel designated by the Owner. Contractor should prepare to provide operator training for up to ten (10) personnel.
   3. Contractor will be prepared to provide training sessions on all work shifts, including day, evening and night shifts.

D. Administrator Training: Instruct Owner-designated security system administrators for each system installed. Administrator training will cover all administrative and management functions, features and controls for each system.

E. Review in detail all information in the Operations and Maintenance Manuals for each system provided.

F. Prior to administering the above training, the Contractor(s) will prepare an outline of the training, identifying the goals and expectations of the course and detailing what attendees are expected to learn.

G. Contractor will provide follow-up training on all of the above subjects at the request of the Owner at additional cost.

H. At the option of the Owner, training courses will be videotaped for subsequent training use by the Owner.

I. In no case will the number of hours allocated toward training be a limiting factor to meeting the training requirements defined herein.

J. Training Submittals:
   1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
   2. Following discussions with Owner, formally submit a Training and Event Attendance submittal two weeks prior to first training. Submittal will:
      a. Include a separate page/entry for every training session.
      b. Indicate date, time, and approximate length of training session.
      c. Indicate person(s) conducting training.
      d. Indicate whether training will be video-taped.

e. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
f. Include signature and title lines for:
   1) Owner acknowledging and accepting training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
   2) Countersigning by trainer indicating that training actually occurred.
   3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
   4) Owner's representative attending training at the end of the session will initial that:
      a) Training Occurred.
      b) Training Materials were provided and left with Owner.
      c) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
      d) Training was generally sufficient for the proposed curriculum.
g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.).

3. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals will be consolidated into a single submittal and submitted every 2 weeks.
4. Provide all training material on DVD in Adobe PDF format.

3.6 SYSTEM TEST AND VERIFICATIONS

A. Contractor will coordinate with Owner's Representative for final tests and inspections in the presence of the Owner and other representatives as the Owner's Representative deems appropriate.

B. Contractor will develop a Final Test and Acceptance (FTAA) Plan. The plan will include the following components:
   1. Contractor will produce an item-by-item completion matrix indicating completion or incompletion for each item included in this Section and any additional direction, addenda, or bulletins issued by the Owner's Representative or other Owner representative. For each incomplete item, indicate the date of completion.
   2. The FTAA Plan will incorporate Owner-provided startup checklists and will follow the Owner standards.
   3. Contractor will perform a complete test of the systems installed to include visual inspections and operational tests of all components. Contractor will submit a report of the test to include system reports produced by the system software for each of the components tested and visual inspection reports for each component.
   4. FTAA Plan will identify each component of the system, intent of test, method or methods of test and expected results. Each component listed in the plan will include space for test part signatures, brief comments, time of test and pass/fail check boxes.
   5. The FTAA plan will be submitted to the Owner's Representative 30 days prior to the scheduled final test.

C. Contractor will ensure that the system is on and fully operational prior to the start of the test. Contractor will provide a minimum of two employees to conduct the test, one of whom will operate software and other head-end equipment, while the other accompanies the Owner's Representative.

D. Owner's Representative will observe a complete and through demonstration of the systems for compliance and issue a final report. Once all items on the report deemed non-operational or non-compliant with the Specification have been corrected and verified by the Owner's Representative the systems will be deemed acceptable.

E. Provide manufacturer's supervision of final testing of each system.

F. Each system must test free from interference, opens, grounds, and short circuits.

G. Following completion of the Final Test, the system will undergo a thirty (30) day Operational Demonstration Test (ODT) or Burn-In period. This operational demonstration period will start when all specified systems and equipment have been installed and "Substantial Completion" is reached, with no more than a moderate number of punch list items remaining. During this period, the system will be operated under a normal facility traffic load for no less than 30 days. If any item or system fails during the ODT, the 30-day burn-in period will be suspended for that item until repaired or replaced. Once repaired or replaced, the burn-in period will recommence. Final

system acceptance of the entire project will be withheld until after successful completion of this operational demonstration period for all systems and components.

3.7 RECORD DOCUMENTATION

A. Subsequent to completion, the Contractor will submit record documentation for the Project. Record documentation will consist of operation & maintenance manuals, as-built drawings, and a document deviation log. All record documentation will be submitted in digital and hard copy format. Record documentation will meet the following requirements:
   1. Digital format: Provide computerized disks, USB drive or compact disks as desired by Owner.
   2. Hard Copy: Provide a single copy, hard cover three ring binder for review purposes.
   3. Provide three (3) final hard copies each in hard covered three ring binder.

B. Operations & Maintenance manuals will meet the following requirements:
   1. Divide into sections for each system, clearly demarcated by a divider titled with the system:
      a. Provide each divider with a tab.
      b. Title each divider with machine print, no smaller than 12 point, to match tabs.
   2. Each section will be sub-divided into consistent sub-sections of information:
      a. Provide each section with a table of contents.
      b. Follow each table of contents with contact person information including their name, responsibility, phone number, and address.
      c. Provide a section with a list of equipment, devices and components included in the section.
      d. Include in the list the manufacturer, parts number and contact person to call for questions on each item.
      e. Follow the list provided with technical information on each listed item, in the order of the list:
         1) Product data sheets which include but are not limited to pictures, descriptions, dimensions, electrical diagrams, circuit board layouts, etc.
         2) Product specifications including but not limited to power requirements, operational criteria, environmental requirements, optical descriptions, etc.
      f. Provide information related to the operation of equipment, devices and components:
         1) Information provided will be specific to the product models actually installed on the project.
         2) Provide information as presented during the training sessions for each system provided for the facility.
      g. Provide complete information required for care and maintenance of all equipment, devices and components installed on the project. Information will include but is not limited to:
         1) Cleaning: Special procedures or use of special chemicals.
         2) Maintaining: Maintenance schedules and tasks, application of products critical to proper operation, types of environmental conditions which need to be maintained or avoided.
         3) Trouble Shooting: Instructions for how to proceed should a problem occur, method of determining the seriousness of the problem, repair instructions for minor problems.
      h. Provide other Project Specific Information:
         1) List of wires, color codes, description of type, tag identification reference.
         2) As built drawings.
      i. Provide operations & maintenance manuals in accordance with the Project General Conditions or as specified in this Section. Where there are conflicts between the Project General Conditions and this Section, provide in accordance with the stricter requirements between the Sections:
         1) Where not addressed in other Sections provide per this specification Section.
         2) See Security Subsystem Specifications for any additional requirements.

C. As-built drawings will meet the following requirements:
   1. As-built drawings will consist of all information indicated under the section herein entitled “Shop drawings”, but updated to include the actual conditions encountered during installation.
   2. As-built drawings will indicate all cable pathways, termination box location and other information related to above-ceiling or concealed equipment locations.
   3. Contractor will provide drawings showing all changes occurring related to documents provided on the project directly related to this section, and all Security Subsystem Specification sections.
   4. Contractor will provide scaled drawings of the same formatted size as those originally issued as contract drawings.
   5. Changes will be indicated with referenced graphics that are properly noted:
      a. Clouding will be bold, but without interfering with or obscure documentation information.
      b. Notes will be alphabetically or numerically referenced.
      c. Notations will not interfere with other information on the documents.
   6. Drawings will be completed in a digital format using AutoCAD® Software. Version of files provided to be determined by the Owner’s Representative at the time that submittal of the information is required.

D. The document deviation log will meet the following requirements:
   1. Contractor will provide a tracking log of changes made to the project that occurred that were in deviation of construction documents, and will be included:
      a. Notification date: Provide day that Owner's Representative was notified that a deviation was required or requested.
      b. Approval Date: Provide the day that approval was provided by the Owner's Representative.
      c. Reason that deviation was required or made.
   2. Provide drawings and photographs of all custom details, and details originally in the contract drawings that were modified:
      a. Drawings to be submitted on 8 ½ inch x 11 inch sheets or larger.
      b. Provide photos that are 5 inch x 7 inch in size or larger. Photographs will be clear, focused and taken with the proper light:
         1) All details will be clearly visible.
         2) All text will be legible.

3.8 ACCEPTANCE

A. System Warranty will not start until Acceptance. Acceptance will be withheld until the following activities have been successfully completed:
   1. Acceptance of all submittals.
   2. Delivery of final documentation.
   3. Successful final test and inspection.
   4. Successful operational demonstration test.
   5. Successful training and demonstration, including operation of systems using the manuals.

B. System contractor will be present at the first use of the facility. The contractor will be on site the day before the event in addition to the day of the event. The event will be decided by the operators as to which one the systems contractor should attend.

3.9 WARRANTY

A. In addition to all guarantees specified in the Project General Conditions, and specific Warranty requirements stated in the Security Subsystem Specifications, furnish the following warranty:
   1. Period: The Contractor will guarantee all labor, workmanship, and materials for a period of one (1) year from the date of Final Acceptance. Should failure occur within the first year to the system, the Contractor will provide all labor and materials necessary to restore the system to the condition required for the final test and acceptance at no cost to the Owner.
   2. Tie-ins: During the Warranty period, additional components may be connected to the installed systems. New devices will be connected in the same manner as shown in the Contract Documents and the existence of the new connections will not void this guarantee. Where software is part of the system, new information will be entered in the database to extend operation of the system.

B. Contractor will/must respond to a request for assistance within 4 hours of receipt and have the repair completed or temporality repaired to the satisfaction of the Owner within 24-hours during the warranty period at no additional cost to the Owner. After-hours service will be available within the four (4) hour window whether or not the Owner elects to purchase a service contract from the Contractor.

C. Contractor's guarantee will include all costs related to troubleshooting, repair and replacement of defective Work, including costs of labor, transportation, materials, equipment and other costs as necessary to restore the system to a complete and operational state:
   1. The Owner must not be without an operational system or component of the system should it require a return to the factory for repair or replacement. It will be the responsibility of the Contractor to replace the component during the 24 hour time period outlined above.

D. Contractor will provide local service by factory trained personnel from an authorized dealer of the equipment manufacturer. Contractor will provide written proof from the equipment manufacturer that said Contractor is duly authorized to sell, service and maintain the specified products. The dealer will have available stock of the manufacturer's standard parts for the primary system components and devices. The dealer will provide sufficient parts in inventory or readily available such that repair will be completed in no more than 24 hours. The inventory of spare parts requirement is assuming availability of components through a dealer network and/or obtained from respective manufacturers within the required time frame.

E. The Contractor will offer an “Optional Three (3) Year Maintenance after Warranty” and an “Optional Five (5) Year Maintenance after Warranty” package to the Owner. The Owner will inform the Contractor of the acceptance or rejection of the package prior to the end of the warranty period.

F. Contractor will correct any software or firmware defects identified during the Warranty period without additional cost to the Owner.

G. This warranty will be in addition to and not a limitation of other rights the Owner may have under the Contract Documents.

H. Contractor will warrant that all Work furnished in this project will be of good quality, free from faults and defects, and in conformance with the Contract Documents.

END OF SECTION 28 05 00

SECTION 28 05 13

CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.

B. The General Security Requirements Specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the General Security Requirements Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the General Security Requirements Specification Section.

C. Not all cables shown within this section will be used on this project.

D. The following sections are related and have interaction between them:
   1. 28 05 00 Common Work Results for Electronic Security
   2. 28 10 00 Access Control
   3. 28 15 15 Direct Interface Integrated Locking Devices
   4. 28 15 23 Intercom Entry Systems
   5. 28 20 00 Video Surveillance
   6. 28 30 00 Intrusion Detection
   7. 28 33 00 Security Monitoring and Control

E. Other related sections:
   1. Division 08 Door Hardware
   2. Division 26 Electrical
   3. Division 27 Structured Cabling and Pathways
   4. Division 07 Firestopping

1.2 DEFINITIONS

A. AWG - American Wire Gauge

1.3 REFERENCES

A. National Electrical Code (NEC)

B. NFPA 70

C. UL 294 and UL 1076 as required where applicable

D. FCC Rules and Regulations

E. Part 15 Class A or B as applicable

F. Applicable Federal, State, and Local laws, regulations and other codes

G. CE mark, as and where applicable

H. C-Tick mark, as and where applicable

1.4 SUMMARY OF WORK

A. Work specified in this Section includes cables used for security systems.

1.5 SUBSTITUTION

A. See Section 28 05 00 Common Work Electronic Security

1.6 SUBMITTALS

A. See Section 28 05 00 Common Work Electronic Security

1.7 RECORD DOCUMENTATION

A. See Section 28 05 00 Common Work Electronic Security

1.8 LABELING

A. Provide labeling in accordance with TIA-606-A Class [2 3 4] numbering and ID format.

B. Provide machine generated labels for each system associated with the Electronic Security System to include but not limited to the following:
   1. Conduit pathways including:
      a. Junction boxes
      b. Pull boxes
      c. Horizontal connection points
      d. Conduit
      e. Cable tray
      f. Grounding busbars
      g. Voltage protection equipment

C. Provide machine generated labels for each component associated with the Electronic Security System to include but not limited to the following:
   1. Access Control Panels
   2. Cameras
   3. Readers
   4. Door Contacts
   5. Termination blocks
   6. Patch panels
   7. Equipment cabinets, racks, frames and enclosures
   8. Power distribution units, power strips

D. Provide machine generated labels for each cable associated with the Electronic Security System to include but not limited to the following:
   1. Copper backbone cables
   2. Fiber optic backbone cables
   3. Horizontal premise cables
   4. Grounding and bonding conductors

E. Provide lamacoid labels for specified equipment.

F. Provide machine generated placards as specified for each TS.

G. Provide labeling materials designed for a lifetime equal to the system, component or cable being identified.

H. Provide labels on the face of wall mount equipment and on the wall adjacent to the equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. “Or approved equal” basis
   1. The products are listed or are on an “approved equal” basis. The known equals to the products specified are listed in each section.
   2. Substitute products not listed in this section may be submitted for approval during the question and answer period of the bidding phase. See substitution requirements in this section.
   3. Substitution approvals will be based on the complete functionality, integration, operation, and user interface as it compares to the specified product(s).
   4. Products not approved prior to the bidding phase will be deemed non-responsive.

B. Pathway shall follow structured cabling Division 27 standards.

C. Provide Wet Rated Cable as required due to project raceways/pathways.

2.2 MISCELLANEOUS EQUIPMENT

A. Demarcation Enclosure for Wet to Dry rated cabling
   1. Provide a Nema 3R rated enclosure with hinge, horizontally swinging lid, and cam lock.
   2. Size the enclosure as needed for the contents.

B. Enclosure contents shall be:
   1. Phoenix Perforated NS 35/7,5 DIN rail to support DIN rail mounted items.
   2. DIN rail mounted Phoenix universal screw terminal blocks model UT2,5 BU, quantity (as needed), end clamp model CLIPFIX 35-5 (as needed), Zack marker strips model ZB 5 (as needed), grounding block model UT 2,5 G for terminal connections (as needed).
      a. Contractor shall label each terminal block to indicate purpose and use.
      b. Provide quantities needed for one wire per terminal

2.3 CABLES AND WIRING

A. 18 AWG, 6 Conductor Stranded Overall Shield (Type A)
   1. Provide Windy City Wire 442351 (Plenum).
   2. Known equals:
      a. Superior Essex 2F-C4x-44
      b. Belden
      c. Bertek
      d. Commscope
      e. General
   3. Wet Rated Cable shall be
      a. Windy City Wire 714410VNQ

B. 18 AWG, 4 Conductor Stranded Unshielded (Type B)
   1. Provide Windy City Wire 442380 (Plenum).
   2. Known equals:
      a. Superior Essex 2F-C32-31
      b. Belden
      c. Commscope
      d. General
   3. Wet Rated Cable shall be
      a. Windy City Wire 727310VNQ

C. 16 AWG, 2 Conductor Stranded Unshielded (Type C)
   1. Provide Windy City Wire 441360 (Plenum).
   2. Known equals:
      a. Superior Essex 2F-C12-31.
      b. Belden
      c. Commscope
      d. General
   3. Wet Rated Cable shall be
      a. Windy City Wire 728110VNQ

D. Network Communication Cable (Type D)
   1. Provide UTP Category cable per Owner/Division 27 standards.

E. 18 AWG, 2 Conductor Stranded Shielded with drain: (Type E)
   1. Provide Windy City Wire 442320 (Plenum).
   2. Known equals:
      a. Superior Essex 2F-C12-32
      b. Belden
      c. Commscope
      d. General
   3. Wet Rated Cable shall be
      a. Windy City Wire 714110VNQ

F. Composite Access Controlled Door Cable (Type F)
   1. Provide Windy City Wire 4461230 (Plenum).
   2. Known equals:
      a. Superior Essex AC-A1x-55
      b. Belden 658AFJ
      c. Commscope
      d. General 4EPL4S
      e. West Penn AC251822B3PYEx
      f. Honeywell 3196
   3. Wet Rated Cable shall be
      a. Windy City Wire 4461111WBT

G. Network Communication Cable (Type G)
   1. Provide UTP Category cable per Owner/Division 27 standards.

H. Network Communication Cable (Type H)
   1. Provide UTP Category cable per Owner/Division 27 standards.

I. Network Communication Cable (Type I)
   1. Provide UTP Category cable per Owner/Division 27 standards

J. Composite Copper Fiber
   1. Provide Windy City Wire 441360 (Plenum).
   2. Known Equals:
      a. Superior Essex
      b. Belden
      c. Bertek
      d. Commscope
      e. General
      f. West Penn
   3. Wet Rated Cable shall be:
      a. Windy City Wire 728110VNQ

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. SMS components shall be shipped to the job-site in original manufacturer’s shipping containers.

B. All shipping and handling costs shall be paid for by the Contractor at no additional cost to the Owner.

C. All equipment stored on the job site shall be secured in a locked storage area as designated by the General Contractor or Owner.

D. The contractor may receive a progress payment for the value of the equipment stored on site if adequate storage space is available.

3.2 TESTING AND COMMISSIONING

A. The Contractor shall be responsible for testing and commissioning the installation in accordance with all applicable documents in the Contract set.

B. Testing shall be comprehensive and sufficient to demonstrate compliance with each requirement.

C. A proposed test plan shall be submitted to the Contracting Officer or Owner’s representative for approval before commencement of final test.

D. Final tests shall be conducted in the presence of the Contracting Officer or Owner’s representative.

3.3 WARRANTY

A. Refer to 28 05 00 Common Work Electronic Security.

3.4 COORDINATION

A. Coordinate custom ACS report requirements. Submit report templates to the Owner's Representative for review and acceptance.

END OF SECTION 28 05 13

SECTION 28 10 00

ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 00 and 01 Specification sections shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.

B. The General Security Requirements Specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the General Security Requirements Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the General Security Requirements Specification Section.

C. This Specification Section incorporates general requirements for the following security sections.
   1. 28 05 00 Common Work Results for Electronic Security
   2. 28 05 13 Conductors and Cables for Electronic Security
   3. 28 15 15 Direct Interface Integrated Locking Devices
   4. 28 15 23 Intercom Entry Systems
   5. 28 20 00 Video Surveillance
   6. 28 30 00 Intrusion Detection
   7. 28 33 00 Security Monitoring and Control

D. Other related sections
   1. Division 08 Door Hardware
   2. Division 26 Electrical
   3. Division 27 Structured Cabling and Pathways
   4. Division 07 Firestopping

1.2 DEFINITIONS

A. AC Alternating Current

B. ACS Access Control System

C. ACP Access Control Panel

D. ADA Americans with Disabilities Act

E. API Application Programming Interface

F. ASCII American Standard Code for Information Interchange

G. AV Audio Visual

H. BACnet Building Automation and Control network

I. BPI Bits Per Inch

J. BPS Bits Per Second

K. CCTV Closed Circuit Television

L. CE European Conformity

M. CPU Central Processing Unit

N. DMU Door Management Unit

O. DVR Digital Video Recorder

P. FASC-N Federal Agency Smart Credential Number

Q. FCC Federal Communications Commission

R. FDA Food and Drug Administration

S. FQRN Fully Qualified Reference Name

T. I/O Input/output

U. ID Identification

V. IDP Intrusion Detection Panel

W. IEC International Electrotechnical Commission

X. IFC Intelligent Field Controller

Y. In-X-It Entry/Exit

Z. ISO International Organization for Standardization

AA. LDAP Lightweight Directory Access Protocol

BB. LAHJ Local Authority Having Jurisdiction

CC. LED Light Emitting Diode

DD. MIS Management Information Systems

EE. MSEA Metasys System Extended Architecture

FF. NEC National Electrical Code

GG. NEMA National Electrical Manufacturers Association

HH. NFPA National Fire Protection Association

II. ODBC Open Database Connectivity

JJ. OPC OLE for Process Control

KK. PIAM Physical Identity Access Management

LL. PIN Personal Identification Number

MM. PSIM Physical Security Information Management System

NN. RAM Random Access Memory

OO. RFQ Request for Quotation

PP. RPC Remote Procedure Call

QQ. SDK Software Development Kit.

RR. SEIWG Security Equipment Integration Working Group

SS. SIA Security Industry Association

TT. SMS Security Management System

UU. SPDT Single Pole, Double Throw

VV. UDF User Defined Field

WW. UDP User Datagram Protocol

XX. UL Underwriters Laboratories

YY. URL Uniform Resource Location

ZZ. VSS Video Surveillance System

AAA. WAMS Wireless Access Management Solutions

BBB. XML Extensible Markup Language

1.3 REFERENCES

A. National Electrical Code (NEC)

B. NFPA 70

C. UL 294 and UL 1076 as required where applicable

D. FCC Rules and Regulations

E. Part 15 Class A or B as applicable

F. Applicable Federal, State, and Local laws, regulations Codes, and other standards

G. CE mark, as and where applicable

H. C-Tick mark, as and where applicable

I. Work specified herein shall comply with specific provisions of codes and standards adopted by the LAHJ as applies to electric locking devices and controlled egress.

J. Where the LAHJ has adopted a less stringent requirement than those required by the 2009 version of the International Building Code (IBC) for control of electric locking devices, the requirements of IBC 2009 shall govern.

1.4 SUMMARY OF WORK

A. Work specified in this Section includes systems used for authentication of credential-holders for physical access through associated portals as well as monitoring of intrusion and other alarm information.

B. Contractor will provide field access control equipment necessary to install card readers.

C. Credentials may be:
   1. Access cards / readers
   2. Keypads / codes
   3. Biometric readers / data

D. Systems shall consist of:
   1. Software
   2. Servers
   3. Workstations

4. Alarm initiation / system ancillary devices
5. The ACS shall provide the following functions:
   a. Access Control
   b. Alarm Monitoring
   c. Cardholder management
   d. Badge creation
   e. System administration
   f. Badge layout (template) creation
   g. Screen/forms creation
   h. Graphical map creation

1.5 SUBSTITUTION

A. See Section 28 05 00 Common Work Electronic Security

1.6 SUBMITTALS

A. See Section 28 05 00 Common Work Electronic Security

1.7 RECORD DOCUMENTATION

A. See Section 28 05 00 Common Work Electronic Security

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers
   1. All access control hardware and software shall be of a single manufacturer including server system, controllers, workstations and input and output terminal modules. The system shall have a fully developed integration with the video surveillance, intrusion detection and intercommunication systems specified on this project.
   2. Unless otherwise noted, all materials and equipment shall be new, of the type, capacity, and quality specified and free from defects. Material shall bear the label of or be listed by the appropriate local listing agency unless of a type for which label or listing service is not provided.
   3. Where multiple items of a similar kind are provided, all shall be identical and of the same manufacturer.
   4. The Contract Documents indicate major system components and may not show every component, connector, module or other accessory that may be required for a complete and operational system. It is the Contractor's responsibility to identify and provide each component necessary for a complete and operational system in accordance with the Contract Documents.

B. Match District Standard.

C. Access Control
   1. Shall be the OSSI System

D. Access Control Panel (ACP)
   1. The access control panel will consist of the power supply and the field panel boards for the specific location.
   2. Inputs:
      a. Provide OSSI IIM input module
   3. Outputs:
      a. Provide OSSI IOM output module
   4. Card Reader Input Board
      a. Provide OSSI CMP IRM
      b. CMP-IRM-203 One Intelligent Reader Module with no daughter board in an enclosure. Includes Power Supply.
      c. CMP-IRM-213 One Intelligent Reader Module with One RS 485 daughter board in an enclosure. Includes Power Supply.
      d. CMP-IRM-403 Two Intelligent Reader Module with One RS 485 daughter board in an enclosure. Includes Power Supply.
      e. CMP-IRM-413 Two Intelligent Reader Module with Two RS 485 daughter board in an enclosure. Includes Power Supply.

f. CMP-IRM-803 Four Intelligent Reader Module with Three RS 485 daughter board in an enclosure. Includes Power Supply.
g. CMP-IRM-813 Four Intelligent Reader Module with Four RS-485 daughter board in an enclosure. Includes Power Supply.
h. CMP-IRM-003 Reader Module Only.

5. Provide batteries for 4 hours of operation on loss of power to include lock power.

E. Electric Lock Power Supply
1. AL600ULPD8

F. Card Reader System (CRS)
1. Card reader system includes the following:
a. Card Reader, wall mount see below.
b. Lock specified in Door Hardware.
c. Request to Exit switch in Door Hardware.
d. Request to Exit motion detector (If not available in door hardware)
e. Door Position Switch.

G. Card Reader System (CRM)
1. Card reader system includes the following:
a. Card Reader, Mullion Mount see below.
b. Lock specified in Door Hardware.
c. Request to Exit motion detector (If not available in door hardware)
d. Door Position Switch.

H. Lock Interface (LI)
1. Lock interface system includes:
a. Interface to access control system panel.
b. Lock specified in Door Hardware.
c. Request to Exit switch in Door Hardware.
d. Door Position Switch.

I. Card Reader
1. Provide OSSI.
a. OSSI OS 300 RFID Reader Mullion Mount.
b. OSSI OS 500 RFID Reader Wall Mount.

J. Credentials
1. Use District Existing Credentials

K. Door Position Switch (D)
1. For Aluminum and Steel doors provide Sentrol 1076/1078.
2. For Surface Mount door provide Sentrol 1285T.
3. For Roof Hatch doors provide Sentrol 2500 series.
4. For Overhead doors provide Sentrol 2202A.

L. Request to Exit Motion Detector (MD)
1. Provide Bosch DS160.

M. Fiber Optic Transceiver (FT)
1. Provide in locations where distance to IDF is greater than 300 feet.
2. Provide Comnet CNMCSFPPOE with Comnet SFP3 for single mode fiber SFP2 for multimode fiber at each end of the cable run.

N. Fiber Optic Transceiver Power Supply (PS2)
1. Provide Comnet PS-DRA240-48A (Adjusted voltage at field fiber optic transceiver to 48 VDC output 0.85A).
2. Must be provided when Fiber Optic Transceivers are used.

O. Access Workstation (WS)
1. Refer to latest manufacturer requirements specifications for the applicable Access Control System.
2. Provide (2) 24” HD monitors connected to each station.

P. Above Door Junction Boxes
   1. Provide above door junction boxes with covers and cam locks for the access control system to house the break out of the combination cable and service loop.
   2. Locate at nearest accessible ceiling.
   3. Acceptable product:
      a. Hoffman 8 inch X 8 inch X 6 inch.

2.2 CABLES AND WIRING

A. See 28 05 13 Conductors and Cables Electronic Security.

B. Pathway shall follow Structured Cabling Division 27.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure that relevant doors and door frames are properly prepared for electric locking hardware and door position switches.

B. Verify acceptance of each type of specified request-to-exit hardware for each application with the LAHJ.

C. Verify fail-safe and fail-secure lock requirements with the Owner's Representative.

3.2 INSTALLATION

A. ACP
   1. Wiring within the ACP panels shall not have more than 0.25" of exposed copper outside of the terminal.
   2. High voltage (120 VAC) shall be separate from low voltage wiring within the panel.
   3. Install the ACP in a readily accessible location as defined in Article 100 of the NEC 2014.
   4. Connect field wiring to boards within the ACP in accordance with manufactures recommendations.

B. End of line supervision
   1. Selected field wiring shall be supervised. Cutting, shorting or altering connections of any wire listed as supervised below, shall be detected, and activate an alarm condition at system workstations. Provide wiring supervision for the following functions:
      a. Door position switches.
      b. Request to exit devices.
      c. Motion sensors.
      d. Glass break sensors.
      e. Perimeter intrusion detection devices.
      f. Any other device which reports a digital (on/off) condition back to the system ACP.
   2. End of line supervision shall detect and annunciate four (4) states. Electrical open and short conditions shall not annunciate as any other condition than trouble or fault within the ACS software.

C. All access control system enclosures shall be provided with tamper switches.

D. Provide signs or labels for all tamper monitored enclosures warning that an alarm will sound if access is attempted and giving the telephone number of the security workstation operator.

E. Multiple Contractor user privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor user privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner. Prior to removal of contractor access privileges, Contractor shall ensure that the Owner has been set up with a master password.

F. Configure the ACS such that devices can be connected to spare input points, output points and card reader inputs on the IFC without requiring reconfiguration of the ACS.

G. Card Readers: Wire card reader LEDs to indicate valid and invalid card reads, and door locked and unlocked conditions. All card reader LED indicators shall operate identically throughout the Project. The LED shall be red in the normal, secured state, and shall be green on valid card read and while the door is unlocked.

H. Electric Locking Mechanisms
   1. Interface with electric locking mechanisms provided under a separate the Door Hardware Section.
   2. Connections shall be wired fail secure except for those electric locking mechanisms the LAHJ has deemed necessary to fail safe. Contractor shall coordinate with Division 08 Door Hardware Section to determine which doors are fail safe.

I. Fire alarm interface
   1. Connect (hard wire) fail-safe electric and time delay locking mechanisms to the building fire alarm system for fail-safe release upon any fire alarm.
   2. Interface with a single low voltage / low current normally closed dry contact from the fire alarm system provided by the fire alarm contractor (coordinate exact locations). The contact shall open on any fire alarm condition.
   3. Provide all additional UL listed fail-safe relays and power supplies necessary to interface to this contact and unlock all fail-safe doors.
   4. Connect fail-safe relays and power supplies to standard building power. Connection of fail-safe devices to emergency or UPS power shall not be acceptable.
   5. Reference the Drawings for fire alarm interface requirements.

J. Provide interface to uninterruptible power system (UPS) for all security head-end components, including those specified in other Security Subsystem Specifications.

K. Install signal in conduit provided as shown on the Electrical and this section drawings. If additional conduit/raceway/tray is required for systems, provide.

L. Conduit/raceway/tray/wire management not shown on these drawings but required for a complete system or by code is to be included in this scope of work. This section cabling exposed to public view is to be in conduit. This section's exterior junction boxes, conduit/raceway, terminations, etc. at, and those within, enclosures where enclosures are exposed to outdoor conditions are to meet NEMA ratings for outdoor electrical applications. If additional conduit/raceway/tray is required for systems, provide.

3.3 PROGRAMMING

A. Enter all data needed to make the Security System operational. Deliver the data to the Owner on data entry forms, utilizing data from the Contract Documents, Contractor's field surveys and all other pertinent information in the Contractor's possession required for complete installation of the database. Identify and request from the Owner any additional data needed to make the Security System fully operational and integrated. Provide the completed forms to the Owner for review and approval at least 30 days prior to the Contractor's scheduled need date.

B. Programming and setup data shall include, at a minimum, the following:
   1. Graphical maps and icons:
      a. Coordinate with the Owner's Representative to obtain AutoCAD architectural backgrounds for implementation as graphical maps. Import all AutoCAD background information provided by the Owner's Representative and produce a complete set of graphical maps depicting all ACS points.
      b. Partition and segregate graphical map displays between "Base Building" and "Tenant" as specified herein.
   2. ACS card reader information:
      a. Coordinate all card reader values and text, including descriptors, alarm messages, VSS camera call up, map call up and identification with the Owner's Representative.
      b. Certain card readers shall be designated for handicap access only. Coordinate special access privileges with the Owner's Representative and program the ACS accordingly.
   3. Input and output points for the ACS. Coordinate all input and output priorities and text, including descriptors, alarm messages, VMS Camera call up, and map call up and identification with the Owner's Representative.
   4. Initial system users, including levels of access. This shall include the designation of an Owner's representative at the "Super User" level immediately upon ACS initialization.
   5. Initial VMS camera call-up and alarm information for interface with VMS system.
   6. Alarm monitoring and automatic shutdown information for the UPS interface.

C. Delivery, Storage, And Handling:
   1. SMS components shall be shipped to the job-site in original manufacturer's shipping containers.
   2. All shipping and handling costs shall be paid for by the Contractor at no additional cost to the Owner.
   3. All equipment stored on the job site shall be secured in a locked storage area as designated by the General Contractor or Owner.

4. The contractor may receive a progress payment for the value of the equipment stored on site if adequate storage space is available.

D. Testing and Commissioning:
1. The Contractor shall be responsible for testing and commissioning the installation in accordance with all applicable documents in the Contract set.
2. Testing shall be comprehensive and sufficient to demonstrate compliance with each requirement.
3. A proposed test plan shall be submitted to the Contracting Officer or Owner's representative for approval before commencement of final test.
4. Final tests shall be conducted in the presence of the Contracting Officer or Owner's representative.

E. Training and Instruction
1. Operator training shall consist of a two-day course conducted on-site by a factory trained professional instructor. Training conducted by unqualified personnel is unacceptable.
2. Training materials shall consist of the following:
   a. Formal course outline and agenda.
   b. Operator training student guide for each student.
   c. Hands on practice with online equipment.
   d. Written examinations.
3. The training course shall be for at least two continuous business days.
4. Additional video imaging training sessions shall be made available to the Owner if necessary, at additional cost.

F. Service Contract Proposal
1. The bidder shall include an optional service contract proposal at the time of bid. The proposal shall include:
   a. Response to emergency service requests on-site, if required.
   b. Replace or repair defective components, as required.
   c. Manufacturer's recommended preventive maintenance.
   d. Two-year and five-year maintenance contract, with price, terms, and conditions shown for each year.
2. The service contract shall be optional, and the Owner shall have the right to accept or reject the contract, and accept only the warranty service as described above, at no additional cost.

3.4 COORDINATION

A. Coordinate cylinder and master key requirements for LAAs and bypass key switches.

B. Coordinate custom ACS report requirements. Submit report templates to the Owner's Representative for review and acceptance.

C. Coordinate initial database partitioning and setup with the Owner prior to initial programming and cardholder data entry.

D. Coordinate door hardware for ACS doors to insure the ACS will function properly.

E. Coordinate IP addressing of all system components.

3.5 PREPARATION FOR SITE OBSERVATION

A. Prior to requesting final site observation of the ACS system, Contractor will submit test sheets for each ACS portal confirming final testing and commissioning has been completed.
1. Minimum data needed for the test sheets.
   a. Project Name
   b. Equipment Type
   c. Equipment location
   d. All components are tested
   e. Wiring installed in conduit or raceway
   f. Grounds installed as specified and tested.
   g. Equipment connections properly torqued.
   h. Batteries installed in control cabinets
   i. Card Readers tested
   j. Control cabinet wiring has been dressed.

k. Equipment labeled
l. Control Panel programmed
m. Access database programing complete
n. Interface to elevator or fire system tested and complete.
o. Network functional to allow head end connection
p. IP address
q. Subnet Mask
r. Controller
s. Sub Controller (If used)
t. Board
u. Point.
v. Testing card results for:
w. Valid
x. Invalid by name
y. Invalid by permission
z. Invalid by no programming
aa. Valid per floor
bb. DC Voltage at Card Reader
cc. Ohm Reading of device wiring from control panel (with resistor at EOL)
dd. Card Reader within 300’ of nearest control panel
ee. Document the system schedule the card reader is assigned.

END OF SECTION 28 10 00

SECTION 28 20 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.

B. The General Security Requirements Specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the General Security Requirements Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the General Security Requirements Specification Section.

C. This Specification Section incorporates general requirements for the following security sections.
   1. 28 05 00 Common Work Results for Electronic Security
   2. 28 05 13 Conductors and Cables for Electronic Security
   3. 28 10 00 Access Control
   4. 28 15 15 Direct Interface Integrated Locking Devices
   5. 28 15 23 Intercom Entry Systems
   6. 28 30 00 Intrusion Detection
   7. 28 33 00 Security Monitoring and Control

D. Other related sections
   1. Division 26 Electrical
   2. Division 27 Structured Cabling and Pathways
   3. Division 07 Firestopping

1.2 DEFINITIONS

A. ACAMS: Access Control Alarm Management System

B. CCD: Charged Coupled Device

C. HD: High Definition

D. IETF: Internet Engineering Task Force

E. IP: Internet Protocol

F. IPS: Images Per Second

G. ITU: International Telecommunications Union

H. MP: Megapixel

I. MPEG: Moving Picture Experts Group

J. NTSC: National Television System Committee

K. ONVIF: Open Network Video Interface Forum

L. PAL: Phase Alternating Line

M. PTZ: Pan, Tilt and Zoom

N. RWC: Regional Watch Center

O. SCC: Security Control Center

P. SD: Standard Definition

Q. VMS: Video Management System

R. WAN: Wide Area Network

1.3 REFERENCES

A. Electronics Industry Association (EIA) RS-170a standard for analog video

B. NTSC broadcast video standard

C. ITU PAL-B broadcast video standard (Referred to herein as simply PAL)

D. ONVIF standards for IP video interoperability

E. MPEG standards for video encoding / decoding

F. ITU-T standards for video encoding / decoding

G. National Electrical Code (NEC)

H. NFPA 70

I. UL 294 and UL 1076 as required where applicable

J. FCC Rules and Regulations

K. Part 15 Class A or B as applicable

L. Applicable Federal, State, and Local laws, regulations and other codes

M. CE mark, as and where applicable

N. C-Tick mark, as and where applicable

O. Work specified herein shall comply with specific provisions of codes and standards adopted by the LAHJ as applies to electric locking devices and controlled egress.

P. Where the LAHJ has adopted a less stringent requirement than those required by the 2009 version of the International Building Code (IBC) for control of electric locking devices, the requirements of IBC 2009 shall govern.

1.4 SUMMARY OF WORK

A. Work specified in this Section includes systems used for visual monitoring and recording of activities within the scene of view of attached cameras and associated features and functions, and equipment as necessary to support this capability.

B. Systems shall consist of:
1. Software
2. Recording servers
3. Management server
4. Recording storage
5. Client Workstations
6. Cameras
7. Network video encoders
8. Camera housings and mounts
9. Video analytics software / firmware

C. The VMS shall provide the following functions:
   1. Video display as necessary for live monitoring and assessment of security incidents
   2. Recording of, and retrieval from, video to digital storage media for historical record
   3. Graphical map creation
   4. System administration
   5. Reports generation

D. The VMS shall consist of a collection of devices by different manufacturers that are seamlessly managed by a single software package over an IP-based communications network. Video generated natively in digital IP format, as well as analog video digitized by an IP encoder shall both be supported by the VMS.

E. The VMS shall have the capability to integrate with intelligent video analysis products for monitoring of specific activities or behaviors that occur within the scene of view of the associated camera.

F. Multiple disparate video surveillance systems shall have the ability to be linked together in a centralized architecture, allowing cameras from any system to be viewed on any other system. The centralized architecture shall be configured and managed in a hierarchical manner.

G. The VMS shall incorporate security measures, including advanced authentication measures and encryption of data.

H. The VMS shall provide for redundancy of video storage using local storage at camera locations where critical or essential as indicated in the Construction Documents. Upon loss of recording server or network connectivity, the camera shall automatically buffer video to local storage, then automatically upload that video to the recording server upon restoral.

I. Components of the VMS that use proprietary digital technologies shall have an associated software developer's kit (SDK) that is published, regularly updated, and available for other manufacturers / software vendors to write to.

1.5 SUBSTITUTION

A. See Section 28 05 00 Common Work Electronic Security

1.6 SUBMITTALS

A. See Section 28 05 00 Common Work Electronic Security

1.7 RECORD DOCUMENTATION

A. See Section 28 05 00 Common Work Electronic Security

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise noted, all materials and equipment shall be new, of the type, capacity, and quality specified and free from defects. Material shall bear the label of, or be listed by the appropriate local listing agency unless of a type for which label or listing service is not provided.

B. Where multiple items of a similar kind are provided, all shall be identical and of the same manufacturer.

C. The Contract Documents indicate major system components and may not show every component, connector, module or other accessory that may be required for a complete and operational system. It is the Contractor's responsibility to identify and provide each component necessary for a complete and operational system in accordance with the Contract Documents.

2.2 "OR APPROVED EQUAL" BASIS

A. The following products listed are on an "or approved equal" basis. The known equals to the products specified are listed in this section.

B. Substitute products not listed in this section may be submitted for approval during the question and answer period of the bidding phase.

C. Substitution approvals will be based on the complete functionality, integration, operation, and user interface as it compares to the specified product(s).

D. Products not approved prior to the bidding phase will be deemed non-responsive.

2.3 MANUFACTURER

A. This project is to provide a new IP video surveillance system for the project. Contractor shall provide licenses for all devices and storage requirements for this project, plus five (5) extra licenses.

B. Acceptable Product:
   1. Shall match existing system.
      a. Known equals:
         1) Genetec Omnicast
         2) S2 VR2 with Magic Monitor
         3) Software House Victor Unified
         4) Milestone, X-Protect
         5) Avigilon Access Control Center
         6) Salient

C. Known Systems Integration Matrix
   1. The system will be integrated between VMS, ACS, Intercom and Intrusion detection systems. The below matrix shows approved integrated groups.
   2. If contractor chooses an item in the matrix below the contractor is required to use the other products in that column of the matrix for this project.

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
VMS	American Dynamics Victor Unified	Genetec Omnicast	S2 VR2	Milestone X-Protect	Avigilon Control Center	Salient
ACS	Software House	Genetec Security Center	S2 Magic Monitor	Open Options	Avigilon Access Control Manager	AMAG Symmetry
ACS Hardware	ACM	Mercury	Mercury	Mercury	Mercury	Multi Node
ACS Power Supply	LifeSafety Sclass	LifeSafety Mclass	LifeSafety Mclass	LifeSafety Mclass	LifeSafety Mclass	LifeSafety Aclass
Intercom	Commend	Commend/ Stentofon	Commend/ Stentofon	Commend	Stentofon	Stentofon
Intrusion	DSC	Bosch	DMP	Bosch	Bosch	DMP

2.4 IP CAMERAS

A. All IP cameras shall be compatible with selected VMS.

B. All IP cameras shall have the following mounting types:
   1.

C	Ceiling Mount
G	Goose Neck/Parapet Mount
L	Pole Mount
R	Recessed/Flush Mount
S	Surface Mount

W	Wall Mount
P	Pendant Mount

2. Mounts shall be as recommended by the individual manufacture for each mounting type.

C. Type 2 Fixed 2MP/1080P Dome with IR
   1. Shall be the, latest version.
      a. Basis of Design
         1) Panasonic WV-3131L(Indoor)
      b. No Substitutions

D. Type 2 Fixed 2MP/1080P Dome with IR
   1. Shall be the, latest version.
      a. Basis of Design
         1) Panasonic WV-2231L(Indoor)
      b. No Substitutions

E. Type 3 – Fixed 2.0MP/1080P Dome with IR
   1. Shall be the latest version:
      a. Basis of Design
         1) Panasonic WV-S2531LN(Outdoor)
         2) Use surge protector Ditek DTK-MRJPOE

2.5 CABLES AND WIRING

A. See 28 05 13 Conductors and Cables Electronic Security.

B. Pathway shall follow Structured Cabling Division 27.

C. Coordinate cable type and installation with Division 27.

2.6 MISCELLANEOUS EQUIPMENT

A. Power Supply
   1. Power Over Ethernet (POE) power sources provided by Owner.

2.7 FIBER OPTIC TRANSCEIVER LINK

A. Provide fiber optic transceivers for cameras that are over 90 meters from the MDF/IDF/IT rooms.

B. Provide NEMA 4 housing for transceiver to be mounted in near camera.

C. Provide NEMA 12 housing for mounting transceivers within IDF rooms.

D. Provide Din Rail mounting of devices in the enclosures.

E. Provide 48 VDC @ 0.85 A at transceiver per transceiver power supply in the IDF room. Power the transceiver next to the camera over composite cable (1) pair 12 AWG, (1) pair fiber copper cable with no splices from IDF.

F. Acceptable Product:
   1. (2) Comnet CNMCSFPPOE with Comnet SFP6 for single mode fiber and SFP2 for multimode fiber. (FOT Type 1).
   2. (1) Comnet CNGE2FE8MSPOE2 with CNMC[2]SFP[POE][/M] and Comnet SFP-6 Module for single mode and SFP 2 for multimode fiber. (FOT Type 2).
   3. (1) Comnet PS-DRA240-48A (Adjust voltage at field transceiver to 48 VDC output 0.85A).

2.8 TECHNICAL REQUIREMENTS

A. Video management software
   1. Shall support all features defined within the section above entitled “Summary of Work”.

2. Video management software shall be scalable up to an unlimited number of connected IP cameras, encoders, and other system devices.
3. Video management software shall be hardware-agnostic, and shall support industry-standard hardware devices such as servers, workstation PCs, storage and other devices from standard industry sources.

B. Server hardware
1. Provide operating system for the system server(s) as per VMS manufacturer requirements. Where multiple system server operating systems are supported by the VMS manufacturer, MS Windows® products shall be used.
2. System server(s) shall comply with all relevant Owner IT requirements.
3. Where the Owner IT Requirements do not provide specific direction, system server and its individual components shall not be proprietary to a specific manufacturer.
4. Minimum specifications for the system server shall be as per the published minimum specifications of the VMS manufacturer. Confirm specific requirements with the VMS manufacturer based on Project capacity and project requirements.

C. Video management server
1. The video management server shall provide for central management of all video recording servers, client workstations, cameras and other system devices.

D. Video recording server
1. The video recording server shall match existing system.
2. The video recording server will be Owner furnished/Owner installed.

E. Video Storage device:
1. Provide a video storage device that can store all the video from all the cameras on this project for forty five (45) days at full resolution and full available frame rate per camera.
2. Provide a device with an active storage controller that will do the following:
   a. Raid 6 8+2, 4+2
   b. 15GB/s sustained large block sequential read performance.
   c. 12GB/s sustained large block sequential write performance.
3. Provide an active controller
4. Provide power fail cache
5. Support Windows
6. Support Enterprise Class 2.5” SSD up to 3.2TB Performance SAS up to 1.8TB, and Capacity SAS 10TB 60 in base unit, up to 396 total with expansion enclosures.
7. Environment:
   a. Operating temperature 10°C to 35°C
   b. Relative Humidity 20% to 80% non-condensing
   c. Altitude -200 ft to 10,000 ft (-61m to 3048m)
8. Acceptable Product:
   a. Data Direct Networks SFA7700X

F. Client workstation hardware
1. The client workstation shall provide for operator interface to the system, including all management, monitoring and control activities.
2. Client workstation shall comply with all relevant Owner IT requirements.
3. Provide operating system for the client workstation as per VMS manufacturer requirements. Where multiple client workstation operating systems are supported by the VMS manufacturer, MS Windows® products shall be used.
4. Where Owner IT Requirements do not provide specific direction, client workstation and its individual components shall not be proprietary to a specific manufacturer.
5. Minimum specifications for the client workstation shall be as per the published minimum specifications of the VMS manufacturer. Confirm specific requirements with the VMS manufacturer based on Project capacity requirements.

G. Network transmission hardware: Coordinate with the Owner’s IT/Telecom group for equipment requirements, including switches, power over Ethernet injectors, and any other network equipment specified within the Construction Documents.

2.9 DIGITAL DISPLAYS

A. Digital displays shall provide for viewing of cameras attached to the system through the system software, either through client workstation computers, via analog video connected directly to the display, or through video decoders connected to the system.

B. Digital displays shall incorporate active matrix thin-film transistor (TFT) liquid crystal display (LCD) technology.

C. Digital displays shall be equipped with VESA compatible mounting hole patterns for compatibility with industry-standard mounting brackets.

D. 24” digital display
   1. Max resolution: 1920x1200 pixels
   2. Brightness: 400 cd/m2
   3. Contrast ratio: 1000:1
   4. Aspect ratio: 16:9
   5. Inputs: 2 – composite video, 1 – S-Video, 1 – DVI/HDMI

E. 60” digital display
   1. Max resolution: 1920x1080 pixels
   2. Brightness: 500 cd/m2
   3. Contrast ratio: 1300:1
   4. Aspect ratio: 16:9
   5. Inputs: 2 – composite video, 1 – S-Video, 1 – DVI/HDMI

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to construction Owner/Owner representative will remove all existing cameras affected by work.

B. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final Product.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
   1. Provide mount appropriate for surface to mount camera on, confirm exact mounting with BISD prior to rough in.
   2. At no point should the weight of any camera be supported by the ceiling tile.

E. Verify all locations of equipment in all rooms with Owner’s Representative, Owner, and Consultant.

3.2 INSTALLATION

A. Multiple Contractor user privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor user privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner. Prior to removal of contractor access privileges, Contractor shall ensure that the Owner has been set up with a master password.

B. Provide interface to uninterruptible power system (UPS) for all security head-end components, including those specified in other Security Subsystem Specifications.

C. Install signal in conduit provided as shown on the Electrical and this section drawings. If additional conduit/raceway/tray is required for systems, provide.

D. Conduit/raceway/tray/wire management not shown on these drawings but required for a complete system or by code is to be included in this scope of work. This section cabling exposed to public view is to be in conduit. This sections exterior junction boxes, conduit/raceway, terminations, etc. at and those within enclosures where enclosures are exposed to outdoor conditions are to meet NEMA ratings for outdoor electrical applications.

E. Field Of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with Owner for final approval.

F. Contractor shall be contractually bound to return to the site two times, during the first three months fo the building normal day to day operations, to adjust cameras views after the Owner's staff has had time to view the system and discover any locations where desired adjustments are needed.

3.3 PROGRAMMING

A. Provide all initial system programming and setup of the VMS system including, but not limited to the following:
   1. Enrollment of all cameras, encoders, and other devices into the VMS software. Provide all necessary configuration of each device, including IP address, name, description, frame rate, compression ratio, resolution, and other required settings.
   2. Configuration of all rules-based actions within the system including setup of initiating events, and all resulting actions.
   3. Initial setup for the interface with the ACAMS. The interface shall provide for automatic VMS camera selection upon alarms within the ACAMS as specified herein and as indicated in the Contract Documents. Coordinate automatic VMS camera selection, real-time record initialization, and VMS record status alarm annunciation requirements with the Owner prior to programming.
   4. VMS software graphical maps and icons. Coordinate with the Owner's Representative to obtain AutoCAD architectural backgrounds for implementation as graphical maps. Import all AutoCAD background information provided by the Owner's Representative and produce a complete set of graphical maps depicting all VMS points.
   5. Automatic selection of a VMS camera adjacent to applicable card readers upon an invalid card use. Coordinate automatic camera selection requirements with the Owner prior to system programming.

3.4 COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:
   1. All products are installed in a proper and safe manner according to manufacturer's instructions.
   2. Insulation and shrink tubing are present where required.
   3. Dust, debris, solder splatter, etc. is removed.
   4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
   5. Labeling has been provided.
   6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
   7. Products are neat, clean and unmarred and parts securely attached.
   8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.

B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards.
   1. Electronic devices are properly grounded.
   2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
   3. Verify each individual component is operating properly.
   4. Verify each individual component's performance meets the manufacturer's published performance for this unit.

3.5 FINAL OBSERVATION AND TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final observation and test will be performed by the Owner or Owner's representative no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and utilize required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures will be performed on each System:
   1. Observation of the methods and means employed to incorporate the System within the facility.
   2. Verification of proper operation, from controlling devices to controlled devices.
   3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
   4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor shall pay for additional time and expenses of the Owner at the standard rate in effect at that time.

3.6 INSTRUCTION OF OWNER PERSONNEL

A. See 28 05 00 Common Work Electronic Security.

3.7 WARRANTY

A. See 28 05 00 Common Work and Electronic Security.

B. See 28 05 00 Common work and Electronic Security

END OF SECTION 28 20 00

SECTION 28 31 00

FIRE ALARM SYSTEMS (PERFORMANCE SPECIFICATION)

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK

A. Provide for new Fire Alarm system and devices in addition areas and existing building areas as indicated on the plans. Coordinate phasing of installation and removal of the existing Fire Alarm system with the architect and general contractor.

B. Provide for the complete removal of the existing Fire Alarm system in existing building areas as shown on plans, upon completion and final acceptance by the AHJ of the new Fire Alarm system in the Gym addition, removal to include all existing cabling from the system to be removed, and all associated initiation, notification and ancillary devices, including power supplies, batteries, chargers and relay panels.

C. The contractor shall utilize all existing current campus room identification for programming of fire alarm zones. Rooms shall be labeled with room names, numbers or both as directed by the architect/owner.

D. Sub-contracting of the fire alarm system or system components is not allowed. Responding proposer shall provide approved manufacturers certification with proposal.

E. Provide for the design and installation of the fire alarm system, with suggested minimum device coverage as indicated. Additional devices may be required for NFPA approved coverage based on existing conditions not known at the time of issue.

F. Where existing devices are removed in walls and hard ceilings, provide stainless steel cover plates of appropriate size to completely cover the entire device opening. Where devices are removed from acoustical lay in ceiling tiles, remove the existing ceiling tile and replace with a new ceiling tile to match the existing adjacent ceiling.

G. Where removal of the device will not allow a stainless steel cover plate, provide a suitable patch of the wall or ceiling, with prep, patch and finish as directed by architect.

H. Provide an integrated tie-in of the addressable Fire Alarm system to the existing Building DDC Building Control system, as follows:

I. Upon detection of smoke at any of the corridor smoke detectors (where required by NFPA 134 or local code), provide fan shut-down for the all of the air handlers noted to have a supply drop serving the corridor. This shutdown will be collective, not by zone.

1. Fire Alarm Contractor shall sub-contract with the District’s DDC Building Automation contractor for this tie-in.

J. Fire Alarm Contractor shall subcontract with a mechanical contractor for all required work related to air handler fan shut-down.

K. Fire Alarm contractor shall provide and install new duct smoke detectors as indicated on plans at both new and existing air handlers and other air conditioning equipment shown.

L. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

M. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the

device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

N. At the time of Bidding, provide unit cost for owner directed changes for the following devices:

1. Smoke Detectors
2. Audio / Visual Devices
3. Visual Only Devices
4. Duct Detectors
5. Pull Stations

O. Contractor to design and provide all equipment, accessories, and materials in accordance with the contract documents to provide a complete and operating system.

P. Conduits, boxes and other raceways required for the Fire Alarm system should be provided by the Fire Alarm Contractor, as required for a compliant design, including any revisions following the approved drawings by the Fire Alarm Contractor.

Q. System to be designed in accordance with all applicable codes including local ordinances, by an experienced and licensed Fire Alarm designer.

R. Building is to be designed to the code minimum but also to include the additional devices / requirements stipulated within this specification. If additional devices indicated require additional design requirements to be code compliant, that is to be taken into account during bidding and designing in order to design and build a fully compliant system.

S. Review and possible changes to design are subject to review by the local Fire Marshal (or authority having jurisdiction), up to Final Testing and Acceptance by AHJ.

T. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, analog addressable intelligent fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies and wiring as shown on the drawings and specified herein. The extent of fire alarm system work is shown on drawings and in schedules, and is hereby defined to include furnishing and installing of a system with the following sequence of operation:

1. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes fire alarm signaling devices, sounding a pre-recorded, voice alarm, providing zone identification at the fire alarm control panel and annunciator panels.
2. Provide DACT provisions for Outside Monitoring to transmit system status. Transmission format shall be verified with the Owner before programming. Services for Outside Monitoring by Owner under separate contract.
    a. Provide LTE/GSM backup on dialer.

U. The Fire Alarm Installation Contractor shall be knowledgeable and experienced in work of a similar nature to determine the extent of the work required, and to prepare shop drawings illustrating the extent of the work to be undertaken, and to pursue the work of the Fire Alarm System installation. The contractor shall review the Architectural, Plumbing, Electrical, Mechanical and Fire Alarm Drawings to fully understand the scope of work. The contractor shall supervise, release, engage and/or monitor all devices required by Code or Local Authority whether specifically indicated on drawings or addressed in specifications. The installing contractor is responsible for meeting all required local and national codes

V. The fire alarm system installer shall warrant.

W. Design Criteria – In addition to designing/providing the code required minimums, the following shall be incorporated into the design utilizing the requirements of the code regarding spacing, location, additional required coverage area, etc:

1. Path of Egress coverage (primarily corridors and assembly spaces) – protected by smoke detectors where required by NFPA 13, for type of building, occupancy and considering automatic fire sprinkler coverage. Do NOT locate smoke detectors in any vestibules.
2. Assembly spaces include: Cafeteria Dining Room, Auditorium, Gymnasiums.
3. Classrooms – ALL classrooms to provide ceiling mount Emergency Communication System (ECS) notification speaker and Visual Strobes.
4. Strobes – each room is to provide a minimum of 1 visual strobe. The location of Voice notification Speaker and Visual combo strobes to be determined by designer based on Db level requirement of the code.
5. Heat Detectors - in addition to spaces required by code, provide at the following rooms: Electrical, Mechanical.

    a. Provide 212deg F heads for the elevator machine room (where applicable).

6. Pull Stations – locations as shown on plans.
7. Fire Alarm Control Panel location – reference plans for location and coordinate exact location with the Fire Marshal prior to installation.
8. Kitchen – Heat detectors at a fixed temperature rating, only where required.
9. Provide in writing any deviations from the above, both exclusion recommendations and additions, for review during submittal. Exclusions are to be reviewed and considered by the owner and design team, but not guaranteed. Possible additions required by code to accommodate the above guidelines are to be included in the base bid. Minimum standards above are to be included in the design base bid, exclusions to be considered with a credit value.

X. This section of the specification includes the final design, furnishing, installation, connection and testing of the microprocessor controlled, analog addressable intelligent fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies and wiring as specified herein. The extent of fire alarm system work required is defined to include furnishing and installing of a system with the following sequence of operation:

1. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes fire alarm signaling devices, sounding a non-coded alarm, providing zone identification at the fire alarm control panel and annunciator panels.
2. Services for Outside Monitoring by Birdville ISD under separate contract.

Y. The contractor shall be an authorized provider and installer of the specified equipment, and shall be knowledgeable and experienced in work of a similar nature to determine the extent of the work required, and to prepare shop drawings illustrating the extent of the work to be undertaken, and to pursue the work of the Fire Alarm System installation. The contractor shall review the Fire Alarm Drawings to fully understand the scope of work. The contractor shall supervise, release, engage and/or monitor all devices required by Code or Local Authority whether specifically indicated on drawings or addressed in specifications.

Z. Sub-contracting of the fire alarm system or system components is not allowed. Responding proposer shall provide approved manufacturers certification with proposal.

AA. The contractor shall utilize the final, approved current campus building and room identification for programming of fire alarm zones. Devices shall be labeled with building names and either room names, numbers or both as directed by the owner.

BB. Sub-contracting of the fire alarm system or system components is not allowed. Responding proposer shall provide approved manufacturers certification with proposal.

CC. Provide for the design and installation of the fire alarm system, with suggested minimum device coverage as indicated. Additional devices may be required for NFPA approved coverage based on conditions not known at the time of issue.

DD. Provide an integrated tie-in of the addressable Fire Alarm system to the Building DDC Building Control system, as follows:

1. Upon detection of smoke at any duct smoke detectors (where required by NFPA 134 or local code), provide fan shut-down for all of the air handlers noted to have a supply drop serving that local area.
2. Fire Alarm Contractor shall coordinate all required work with the Building Automation contractor for this tie-in.

EE. Fire Alarm contractor shall provide all duct smoke detectors as shown on mechanical plans, coordinate with mechanical contractor for installation on all units scheduled to be rated at over 2000cfm.

1. Fire Alarm Contractor shall coordinate with the mechanical contractor for all required work related to air handler fan shut-down.
2. Fire Alarm Contractor shall provide all duct detector devices, enclosures to the mechanical for installation, and the mechanical contractor shall provide fan shut down.

FF. Satisfying the Entire Intent of these Specifications

1. It is the contractor’s responsibility to meet the entire intent of these specifications. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the architect, engineer, and owner's representative. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the electrical contractor.

1.2 SCOPE OF THE WORK

A. An intelligent reporting, microprocessor controlled fire detection and emergency alarm communication system shall be installed in accordance with the specifications, and all applicable codes.

B. The system shall be designed such that each signaling line circuit (SLC) shall be limited to only 80% of its total capacity used during the initial installation.

C. The FACP and peripheral devices shall be manufactured 100% by a single manufacturer (or division thereof).

D. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

E. Coordinate with District for availability and set up of monitoring telephone lines.

1.3 PERFORMANCE

A. Alarm and trouble signals shall be digitally encoded by listed electronic devices onto an NFPA Style 6 looped multiplex communication system.

B. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Signaling Line Class A circuits.

C. Initiation Device Circuits (IDC) shall be wired Class A circuits.

D. Notification Appliance Circuits (NAC) shall be wired Class B.

E. Power for initiating devices and notification appliances must be from the main fire alarm control panel to which they are connected.

F. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

G. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

H. Audible notification and control equipment shall be arranged such that loss of any one (1) circuit will not cause the loss of any other horn circuit in the system.

1.4 SYSTEM OPERATION

A. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1. The System Alarm LED shall flash.
2. A local piezo-electric signal in the control panel shall sound.
3. The 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
5. The audio portion of the system shall sound the proper signal to the appropriate zones.

1.5 QUALITY ASSURANCE

A. Provide fire alarm system produced by one of the following manufacturers, while meeting or exceeding the minimum performance specification included herein.

1. Honeywell – Farenhyt, Black Series, is the preferred manufacturer of the fire alarm system, acceptable equal by;
2. is the preferred manufacturer of the fire alarm system, acceptable equal by;

a. Other approved in writing prior to bid.

B. Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories, Inc., and which comply with NEMA Standards.

C. The National Fire Protection Association publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Use current locally adopted editions of the standards.

1. No. 72A Local Protective Signaling Systems.
2. No. 72D Proprietary Protective Signaling Systems.
3. No. 72E Automatic Fire Detectors.
4. No. 90A Installation of air conditioning and ventilating systems.
5. No. 101 Life Safety Code.

D. The contractor furnishing and installing the equipment shall show satisfactory evidence with the shop drawings that they maintain stocks of replacement parts, and maintain a service department which is fully capable of maintaining the equipment.

E. Fire alarm systems shall be installed by an agent having a current certificate of registration with the State Fire Marshal's Office of the Texas State Board of Insurance, in accordance with state law. A "Fire Alarm Installation Certificate" shall be provided as required by the Office of the State Fire Marshall.

F. Warranty:

1. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
2. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
3. Contractor shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of five years from the date of acceptance of the entire project (substantial completion).
4. The Owner shall give notice of observed defects with reasonable promptness.
5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

6. The Contractor shall include all cost within their proposal to provide a full fire alarm system, annual re-certification prior to the beginning of the school year **(2019-2020)**, following the initial system acceptance and certification, and shall include all cost for any corrective issues related to coverage and initiation design discovered by the certification, and not previously noted as warranty items. This excludes any additions, renovations or modifications to the building or fire alarm system that are not identified prior to the initial acceptance and certification of the system.

G. Project Record Documents:

1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data, in multiple duplication (three each), prepared in 3-ring binders of sufficient size, black in color, neat in appearance and turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
    a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract
    b. Approved fixture/equipment brochures
    c. Copies of approved Shop Drawings
    d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
    e. Any and all data and/or plans required during construction.
    f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.
    g. The first page or pages shall have the name, addresses and telephone numbers of the following; General Contractor and all sub-contractors, Major Equipment Suppliers.

H. Training:

1. Upon completion of the work and at a time designated by the Owner’s representative, provide a formal training session for the Owner’s operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner’s representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner’s representative and Engineer as a condition of final acceptance.

I. Plans and Specifications:

1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

J. Utilities, Locations and Elevations:

1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees as to the accuracy.

2. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage/phase/pressure/capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities that may not be shown on the plans.

1.6 SUBMITTALS

A. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout and main control panel module layout, configurations and terminations.

B. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

C. Software Modifications:

1. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

D. Certifications:

1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

D. The main fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.2 MAIN FIRE ALARM CONTROL PANEL AND FIRE COMMAND CENTER:

A. The main FACP Central Console shall be a Honeywell Farenhyt Series IFP-2100 and shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, Remote Annunciator Panels.

B. Control Panel

1. Control Panel with Emergency Communications System

a. The fire alarm control panel (FACP) shall be the Honeywell Farenhyt Series IFP-2100ECS analog addressable fire alarm control panel and emergency communication system. The audio amplifiers shall be the Honeywell Farenhyt Series ECS-50W, ECS-125W, ECS-INT50W or ECS-DUAL50W voice evacuation units. The FACP must have a 9 amp power supply and be capable of expansion to a minimum of 384 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.

b. The system must contain at least one (1) Honeywell Farenhyt Series ECS-50W, ECS-125W, ECS-INT50W or ECS-DUAL-50W amplifier and shall be expandable from 50 to 2000 watts utilizing up to 15 additional amplifiers. The ECS-50W and ECS-125W amplifiers shall be capable of adding a 4 zone splitter (ECS-CE4) to distribute the audio information to different locations in the installation. The system shall have the capability of controlling up to 64 notification zones. The amplifiers must contain the capability of being remotely located through a four-wire SBUS communications circuit and a two-wire VBUS voice circuit.

c. The voice evacuation system must have the capability of downloading fifteen (15) 60 second messages and utilize DSP technology for higher audio intelligibility

d. The voice evacuation system shall be capable of operating at 25vrms or 70.7vrms (ECS-50W, ECS-INT50W and ECS-DUAL50W only) and must be field selectable at the amplifier level. Systems that require additional modules for voltage conversion shall not be accepted.

e. The FACP must have Day/Night sensitivity capabilities on detectors and be capable of supporting 159 detectors and 159 analog addressable modules and expandable to a maximum of 2,100 analog addressable points per FACP. This shall be accomplished via a maximum of 63 signaling line circuits (SLC) capable of supporting up to 159 detectors and 159 addressable module devices each. The communication protocol on the SLC loop must be digital.

f. The FACP must be capable of being networked to create a virtual system that is larger than 2,100 addressable points. The FACP network must support up to 32 FACPs on the network providing a maximum addressable point capacity of 67,200 points (2,100 x 32 = 67,200).

g. The FACP must support a minimum of eight programmable “Flexputs”. The panel must have a built in 160 character LCD annunciator with the capability of having a minimum of an additional 63 supervised remote annunciators connected in the field.

h. The FACP must have a built in UL approved IP and digital communicator with the option of adding a cellular module for communications. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.
i. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.
j. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have day/night sensitivity adjustments, maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core operating software on site or over the telephone.
k. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system. Panels that do not have these capabilities will not be accepted.
l. The main communication bus (S-BUS RS485) shall be capable of class A or class B configuration with a total Bus length of 6,000 feet.

C. System Wiring

1. The Signaling Line Circuit (SLC) and data communication bus (SBUS) shall be wired with standard NEC 760 compliant wiring. No twisted, shielded or mid-capacitance wiring is required for standard installations. All FACP screw terminals shall be capable of accepting 14-18 AWG wire. All system wiring shall be in accordance with the requirements of NFPA 70, the National Electrical Code (NEC) and also comply with article 760 of the NEC.

D. Signaling Line Circuits

1. Each SLC shall be capable of a wiring distance of 5,000 feet from the SLC driver module (6815) and be capable of supporting 159 detectors and 159 addressable module devices. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 10 seconds. The auxiliary 6815 SLC loop module must be capable of being located up to 6000 feet from the FACP on an RS-485 bus, which is separate from the SLC bus. The SLC shall be capable of functioning in a class A or class B configuration.

E. SLC Loop Devices

1. Devices supported must include analog photoelectric, analog heat detectors, addressable input modules, relay output modules or addressable notification modules. There is to be no limit to the number of any particular device type up to the maximum of 159 detectors and 159 addressable modules that can be connected to the SLC.

F. Addressable Detector Functions

1. The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:

a. Provide intelligent addressable devices that utilize SK Protocol. Devices that use IDP or Hochiki communication protocol will not be accepted.
b. Automatic compliance with NFPA 72 standards for detector sensitivity testing.
c. Drift compensation to assure detector is operating correctly.
d. Maintenance alert when a detector nears the trouble condition
e. Trouble alert when a detector is out of tolerance
f. Alert control panel of analog values that indicate fire.

G. Sensitivity function

1. The FACP shall have the ability to set three different sensitivity levels. A zone can be programmed to a day and a night sensitivity value. The day/night schedule shall allow for 16 holiday dates that are user programmable to allow the FACP to respond at the night level on those days.

H. Programmable Flexputs

1. The FACP shall support eight (8) programmable Flexput circuits that are capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power. The circuits shall also be programmable as input circuits in Class A or Class B configurations to support dry contact or compatible two wire smoke detectors.

I. Addressable Notification Module

1. The contractor shall furnish and install where indicated on the plans, addressable notification modules, Honeywell Farenhyt Series Model SK-CONTROL. The modules shall be U.L. listed compatible with Honeywell Farenhyt Series IFP-2100ECS fire alarm control panel. The notification module must provide one class A (Style Z) or class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The SK-CONTROL shall reside on the SLC loop and can be placed up to 5,000 feet from the control or 6815 SLC loop module.

J. Annunciators

1. The main control must have a built in annunciator with a 160-character LCD display and feature LED's for Alarm, Supervisory, Trouble, Silenced and Power. When in the normal condition the LCD shall display time and date based on a 200 year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 in. No membrane style buttons will be permissible. The annunciator must be able to silence and reset alarms. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.

K. Remote Annunciators

1. The fire system shall be capable of supporting remote annunciators. LCD Remote annunciator, Model RA-2000, shall have the same control and display layout so that they match identically the built in annunciator. Remote annunciators shall be available in two colors, red and light gray. Remote annunciators shall have the same functionality and operation as the built-in annunciator. All annunciators must have 160-character LCD displays and must feature five LED's for Alarm, Supervisory, Trouble, Silenced, and Power. All controls and programming keys are silicone mechanical type with tactical and audible feedback. Keys shall have a travel of .040 inches. No membrane style buttons will be permitted.
2. The annunciator must be able to silence and reset alarms. The annunciator must have twenty levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple users input simultaneously. Remote annunciators shall be capable of operating at a distance of 6,000 feet from the main control panel on unshielded, non-twisted cable.

L. I/O Module

1. The fire system shall be able to support I/O modules (SK5880) that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs, including ECS inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and be suitable for alarm and trouble circuits as well as reset and silence switches. The system shall also support up to 40 LED drivers that reside on the two-wire SLC loop. These driver boards shall contain 80 LED outputs that are powered by an external power source.

M. Serial/Parallel Interface

1. The fire system shall be capable of supporting up to two serial/parallel interfaces (SK5824) that are capable of driving standard computer style printers. The interface shall be programmable for the serial and parallel ports and allow printing of events as they occur.

N. Distributed Power Modules

1. The contractor shall supply power modules, Models RPS-1000 and 5496, compatible with the IFP-2100ECS fire alarm control panel. The RPS-1000 power module must have 6 amps of output power, six Flexput™ circuits rated at 3amps each, and two form C relay circuits rated at 2.5 amps at 24 volts DC. The six Flexput™ circuits shall have the same functionality as the Flexput™ circuits on the main panel. The RPS-1000 shall be capable of being connected via an RS-485 system bus (SBUS) at a maximum distance of 6,000 feet from the main control panel. The RPS-1000 shall contain an additional RS-485 bus that is completely compatible with all IFP-2100ECS add on modules; including 6815 SLC expanders, RA-2000-SK5865-SK5880 annunciators, 5824 serial/parallel module and addressable devices. The RPS-1000 will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6,000 feet from the power module.
2. The 5496 power module must have 6 amps of output power and four circuits rated at 3 amps each. The four circuits can be programmed as notification outputs or auxiliary power outputs of door holder, constant and resettable types.

O. Digital Communicator

1. The digital/IP communicator must be an integral part of the control panel and be capable of reporting all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct messages to a central station or remote station. The communicator must also be capable of up/downloading of all system programming options, event history and detector sensitivity compliance information to a PC on site or at a remote location.
2. The communicator shall transmit the information by one or more of the following means of communication – internet, cellular or standard telephone lines. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage. No controls that use external modems for remote programming and diagnostics shall be accepted.

P. Dry Contacts

1. The FACP will have three form “C” dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, sprinkler supervisory, notification, pre-alarm, waterflow, manual pull, aux. 1 or aux. 2. The trouble contact shall be normal in an electrically energized state so that any total power loss (AC and Backup) will cause a trouble condition. In the event that the Microprocessor on the FACP fails the trouble contacts shall also indicate a trouble condition.

Q. Ground Fault Detection

1. A ground fault detection circuit, to detect positive and negative grounds on all field wiring. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground fault will not interfere with the normal operation, such as alarm, or other trouble conditions.

R. Overcurrent Protection

1. All low voltage circuits will be protected by microprocessor controlled power limiting or self-restoring poly-switches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

S. Test Functions

1. A Lamp Test mode shall be a standard feature of the fire alarm control panel and shall test all LEDs and the LCD display on the main panel and remote annunciators.
2. A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for two seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested, the zone tripped, the zone restore and the individual points return to normal.
3. A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.

4. A bypass mode shall allow for any point or NAC circuit to be bypassed without effecting the operation of the total fire alarm system.

T. Remote Input Capabilities

1. The control panel shall have provisions for supervised switch inputs for the purpose of Alarm reset and Alarm and trouble restore.

U. Notification Appliance Mapping Structure

1. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 999 output groups. Each of these groups shall have the ability to be triggered by any of the panels 999 zones, panel wide events, or site wide events. Additionally each zone, panel, or site will individually control the cadence pattern of each of the groups that it is mapped to so that devices can indicate a variety of conditions. The zone, panel, or site shall be capable of issuing a different cadence pattern for each of the groups under its control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices. Zones shall have ten different output categories; Detector Alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual Pull, Zone Auxiliary 1 and Zone Auxiliary 2, CO Alarm and CO Supervisory.
2. Each of the categories shall have the ability to control output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California Code, Zone 1 Coded, Zone 2 Coded, Zone 3 Coded, Zone 4 Coded, Zone 5 Coded, Zone 6 Coded, Zone 7 Coded, Zone 8 Coded, Custom Output Pattern 1, Custom Output Pattern 2, Custom Output Pattern 3, Custom Output Pattern 4, Constant, System Sensor Synchronization, Wheelock Synchronization, Gentex Synchronization, Amseco Synchronization, and Faraday Synchronization. This mapping/cadence pattern shall be supported by all system power supplies. 15 recordable one minute messages are available that can be mapped to eight ECS buttons. ECS messages can have priority over fire alarm outputs.

V. On-board Programmer

1. The FACP shall have an on board programmer which will allow for all system functions and options, except for mapping, to be programmed via the on board annunciator keypad. Any panel that does not have this capability will not be accepted.

W. Downloading Software

The fire alarm control panel must support up/downloading of system programming from a Windows based PC. The FACP must also be able to download the detector sensitivity test results and a 1000 event system event buffer to the PC. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or over the phone lines.

X. English Language Descriptions

1. The FACP shall provide the ability to have a text description of each system device, input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

2.3 System Operations

A. Alarm

1. When a device indicates any alarm condition the control panel must respond within 10 seconds. The General Alarm or Supervisory Alarm LED on the annunciator(s) should light and the LCD should prompt the user as to the number of current events. The alarm information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
2. When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.

3. An alarm shall be silenced by a code at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal.

B. Trouble

1. When a device indicates a trouble condition, the control panel System Trouble LED should light and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
2. When the device in trouble is restored to normal, the control panel shall be automatically reset, The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by a code or at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

C. Supervision Methods

1. Each SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.
2. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

D. Control Unit

1. System Cabinet
    a. Mounting
        1) The system cabinet shall be red and can be either surface or flush mounted. The cabinet door shall be easily removable to facilitate installation and service.

E. Audible System Trouble Sounder

1. An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.

F. Power Supply and Charger

1. The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 9 Amps. The FACP must have a battery charging circuit capable of complying with either of the following requirement:
    a. Sixty (60) hours of battery standby with five (5) minutes of alarm signaling at the end of this sixty (60) hour period (as required per NFPA 72 remote station signaling requirements) using rechargeable batteries with automatic charger to maintain standby gel-cell batteries in a fully charged condition.
    b. Twenty-four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period (as required per NFPA 72 central station signaling requirements) using rechargeable batteries with automatic charger to maintain gel-cell batteries in a fully charged condition.
2. The power supply shall comply with U.L. Standard 864 for power limiting.
3. The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A “Battery Test” will be performed automatically every minute to check the integrity of the batteries.

The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.

4. In the event that it is necessary to provide additional power one or more of the Model RPS-1000 or 5496 distributed power modules shall be used to accomplish this purpose.

G. Connectors and Circuits

1. Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Fire Alarm Code NFPA 72, National Electrical Code (NEC) NFPA 70, and the local authority having jurisdiction (AHJ). The circuit and connections shall be mechanically protected.
2. A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked “FIRE ALARM CIRCUIT CONTROL”.

H. Accessory Components

1. The FACP shall support the following devices on the RS-485 data bus:

a.	6815	Signaling Line Circuit Expander (SLC) Module
b.	5824	Printer Interface Module
c.	RA-2000	LCD Remote Annunciator
d.	5865-3	LED Remote Annunciator
e.	5865-4	LED Remote Annunciator with reset and silence switches
f.	5880	LED I/O module
g.	RPS-1000	Intelligent Distributed Power Module
h.	5496	Remote Addressable Power Supply 6.0 Amp

2. The FACP shall support the operation of 159 detectors and 159 addressable module total devices per SLC loop without regard to device type.

I. Provide fire alarm system products in sizes and capacities indicated, complying with manufacturer's published product information on standard materials and components designed and constructed for applications indicated.

J. Provide required basic wiring materials as specified in Division 26 sections. Comply with manufacturer's instructions and recommendations.

K. Speakers: Provide manufacturer's standard construction fire alarm speaker, System Sensor Spectra-Alert Advance. UL listed to Standard 1971 and shall meet the following criteria:

1. Ceiling Mount:
   a. Indoor - System Sensor SPCWL(V) Dual voltage (25/70.7 Vrms) with high volume dB sound output where required for coverage.
2. Wall Mount:
   a. Indoor - System Sensor SPWL(V) Dual voltage (25/70.7 Vrms) with high volume dB sound output where required.
   b. Outdoor- System Sensor SPW(K) Dual voltage (25/70.7 Vrms) with high volume dB sound output where required for coverage.

L. Speaker Strobes: Provide manufacturer's standard construction fire alarm speaker / strobe, System Sensor L-Series. UL listed to Standard 1971. . Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. Ceiling Mount:
   a. Indoor - System Sensor Advance Speaker Strobe SPCWL Dual voltage (25/70.7 Vrms) with high volume dB sound output, and candela setting as required for coverage.

2. Wall Mount Mount:

    a. Indoor - System Sensor SPSRL Dual voltage (25/70.7 Vrms) with high volume dB sound output, and candela setting as required for coverage.
    b. Outdoor - System Sensor SPSRK Dual voltage (25/70.7 Vrms) with high volume dB sound output, and candela setting as required for coverage.

M. Strobes: Provide manufacturer's standard construction fire alarm strobe, with flashing xenon light visual signal. UL listed to Standard 1971. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. Strobes: Provide manufacturer's standard construction fire alarm strobe, System Sensor L-Series. UL listed to Standard 1971. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

    a. Ceiling Mount:

        1) Indoor - System Sensor L-Series Strobe SCWL, Dual voltage (25/70.7 Vrms) with candela setting as required for coverage.

    b. Wall Mount:

        1) Indoor - System Sensor L-Series Strobe SRL, Dual voltage (25/70.7 Vrms) with candela setting as required for coverage.

2. The maximum pulse duration shall be 2/10 of one second.
3. Strobe intensity shall meet the requirements of UL 1971.
4. The flash rate shall meet the requirements of UL 1971.

N. Addressable Devices - General

1. Addressable devices shall provide an address-setting means using rotary decimal switches.
2. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches. Devices which use a binary address or special tools for setting the device address, such as a dip switch are not an allowable substitute.
3. Detectors shall be analog and addressable, and shall connect to the fire alarm control panel's Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual (2) status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs can be programmed off via the fire control panel program.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time-of-day basis.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature.
8. The following bases and auxiliary functions shall be available:

    a. Sounder base rated at 85 DBA minimum.
    b. Form-C Relay base rated 30VDC, 2.0A.
    c. Isolator base.

9. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).

O. Addressable Pull Box (Pull station): Provide manufacturer's standard construction, red enclosure, manual fire alarm stations, double action semi flush mounting, Silent Knight SK-PULL-DA, addressable.

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75" or larger. Provide "Stopper II" with local audible alarm at each pull station location. Provide "Weather Stopper II" with local audible alarm at exterior locations. (Verify with Each Authority Having Jurisdiction on acceptance of audible alarm on pull station covers.) Where allowed by Local Authority. Provide without audible alarm where audible alarm is not allowed.

P. Intelligent Photoelectric Smoke Detector: Provide manufacturer's standard construction automatic photoelectric type smoke detector, Silent Knight SK Protocol type with base, SK-PHOTO-W.

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

2. Where smoke coverage is required by NFPA 72, or local authority, high volume spaces such as, Gyms, Auditorium and other high ceiling (above 18ft.) are to have FAAST (aspirated smoke detectors).

Q. Intelligent Thermal Detectors (Heat Detector)

1. Thermal detectors shall be intelligent addressable devices rated at 135°F and have a rate-of-rise element rated at 15° F per minute. It shall connect via 2 wires to the fire alarm control panel signaling line circuit, Silent Knight, SK Protocol type with base, SK-HEAT-W.

R. Intelligent Duct Smoke Detector: (Duct Detector) Provide manufacturer's standard construction automatic smoke detectors, duct type, with sampling tubes, Silent Knight SK Protocol type, SK-DUCT with SK-PHOTO-W smoke detector and housing, with auxiliary contacts for fan shut down as required. (Provided and installed by Fire Alarm Contractor, Addressable Device.)

1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. Duct detectors located above ceiling level shall have device labeled alarm LED test/reset switch in ceiling below detector and clearly readable from floor level. Provide with manufacturers optional accessory remote test/reset for ceiling mount.
3. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

S. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops. Silent Knight SK-MONITOR or SK-MINIMION.
2. The monitor module shall mount in a 4" square, 2" deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2" x 1-3" x 2". This version need not include Style D or an LED.

T. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. Silent Knight SK-CONTROL.

2. The control module shall mount in a standard 4" square, 2" deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

U. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building. Silent Knight SK-ISO.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4" deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

V. Remote Power Supplies

1. The remote power supplies for notification appliances shall be the Model RPS-1000 or 5496. The Model RPS-1000 intelligent power supply shall wire on the main SBUS and be programmed through the IFP-2100ECS. It will support 6 amps of 24 volt DC power with 8 Flexput™ circuits, rated at 3 amps each. Two additional 6815 SLC loop expanders shall be capable of be install in the cabinet. The power supply will also regenerate the SBUS for an additional 6000 feet of SBUS capability.
2. The 5496 intelligent power supply shall wire on the main SBUS and be programmed through the IFP-2100ECS. It will support 6 amps of 24 volt DC power with 4 notification circuits, rated at 3 amps each.
3. The remote power supply model 5499 or 5495 may also be used on the system. These power supplies are activated by a notification circuit or an SK-Protocol control module and support 6 or 9 amps of 24VDC power, with 4 notification circuits, rated at 3amps each.

W. Intelligent Isolator Base

1. Fully supervised, tamper-proof isolator base for SK Series detectors. SK Protocol type, B224BI.

X. Intelligent Fault Isolator Module

1. Addressable line isolator module, SK Protocol SK-ISO.

Y. Intelligent Relay Module

1. Addressable relay module, with rotary address switches, and two sets of From C contacts. SK-Relay.

Z. Intelligent Notification Module

1. Addressable notification module, with rotary address switches. SK-Control.

AA. Intelligent Monitor Module

1. Addressable notification module, with rotary address switches. SK-Monitor.

BB. Door Holders and Closers:

1. Door holders, flush mounted standard hardware depth. Silent Knight FM998-120 or equal. Refer to electrical drawings for additional information and mounting locations.

CC. Cable

1. Provide cable color jacket for the following system circuits as noted below:

   a. SLC – Red.
   b. NAC – Red with Blue trace.
   c. Speaker – Red with Green trace.
   d. Auxiliary power – Red with Yellow trace.
   e. SYNC wire – Black.

DD. System Record Document Cabinet

1. Provide wall mounted Fire Alarm record document cabinet, (1) per campus, exact location to verified with owner prior to installation. Cabinet to be constructed of 16ga. Steel, with a solid piano hinge for the door, and key lock. Provide with 4GB USB flash drive (or adequate size required for storage of all related documents, and software) equal to SRD ACE-11, by Space Age Electronics. Provide with custom project lettering with the campus name, and lock keyed to the fire alarm control panel.

2.4 BATTERIES AND EXTERNAL CHARGER:

A. Battery:

1. Shall be 12 volt, Gell-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free.
4. Final battery size to be calculated & confirmed by system installer based on actual system loads.
5. External, physical dimension shall allow for placement within system enclosure.

B. External Battery Charger:

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt 60 hertz source.
2. Shall be rated for fully charging a completely discharged battery within 60 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.
5. Final battery charger characteristics to be calculated & confirmed by system installer based on actual system loads.

C. Microprocessor based monitoring and control system.

1. The monitoring and control system shall consist of a central processing unit, (CPU), Display Interface Assembly DIA, Remote Annunciator Panels. The system shall be of modular construction, with components connected together using multiplex wiring techniques to provide Fire Detection and Evacuation signals. System shall be Silent Knight IFP-2100ESC Intelligent, Addressable, and Analog Multiplex Life Alarm or approved equal. CPU shall be surface or flush wall mounted control units where shown. Unit shall have all necessary components to completely supervise and operate the system. Power wiring shall be for single phase operation. Unit shall include the following functional equivalents, as required:

   a. Zone modules.
   b. Power supplies.
   c. Emergency battery for 60 hour backup.
   d. Battery charging circuit.
   e. Auxiliary relays.
   f. Common module.
   g. Controls: System reset, acknowledge, lamp test, trouble, silence.
   h. Indicators: Common alarm, common trouble, AC power failure, low battery, and power on.
   i. Other equipment and components as required for system operation.

2. System shall provide LCD annunciation to indicate system monitor point status, and toggle switches to allow operation of the system control points. Unit shall function as a zone annunciator and control center to initiate alarm or building evacuation function. Control center and Remote Annunciator shall be wall mounted, located as shown, with battery backup, self-contained power supply supplied by 120 volt emergency power if available or by dedicated 120 volt normal power circuit.

D. Provide fire alarm system products in sizes and capacities indicated, complying with manufacturer's published product information on standard materials and components designed and constructed for applications indicated.

E. Provide required basic wiring materials as specified in Division 26 sections. Comply with manufacturer's instructions and recommendations.

F. Tamper switches and water flow alarms, when furnished with sprinkler system, shall be connected to Fire Alarm System.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system and materials in accordance with manufacturer's instructions and roughing in drawings, and details on the drawings. Install electrical work and use electrical products complying with requirements of applicable Division 16 sections of these specifications.

B. The term "wiring" is defined to include the providing of wire, conduit and miscellaneous materials as required for mounting and connecting the electrical devices. All wiring and devices shall be fully concealed unless otherwise approved by Engineer.

C. Install a complete wiring system as required by the local authority for fire alarm system conductor shall be two twisted pair fire alarm cable in a separate conduit system. Provide multi- conductor instrument harness bundle in place of single conductors where a number of conductors can be run along a common path. Fasten flexible conductors bridging cabinets and doors neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. Install a flashing light and speakers where required by the Local Authority Having Jurisdiction.

E. Manual stations are to be set 48" above finished floor. Alarm devices are to be set at 80" aff maximum. Alarm devices in Activity rooms, Gymnasiums and other similar use areas shall be suitably protected with substantial wire guards, not less than 11 gauge, and 1" x 2" mesh.

F. Identification of individual detectors is required. All devices, including notification appliances shall be labeled with applicable circuit identification number. Identification labels must be printed labels with black lettering on a clear background. Labels must be machine printed, self-adhered and of sufficient font size to be clearly readable from the floor level. Handwritten labels or labels made from embossed tape are not acceptable.

G. Number code or color code conductors, appropriately and permanently for identification and servicing of system.

H. Provide and install new duct detectors in air handling equipment. Fire Alarm contractor will need to coordinate with the mechanical contractor for final tie-in and set-up.

3.2 CONNECTIONS

A. The Contractor shall make provisions for and shall connect initiating devices to the Fire Alarm System which may be furnished under other sections of these specifications, whether specifically indicated on the Electrical Series drawings or not. This Contractor shall furnish wiring, make final connections to auxiliary

devices furnished under other sections of the specifications, and provide interface devices such as relays where required, some of these components may be outside buildings:

1. Door Hold Open devices.
2. Fire Door release devices.
3. Duct detectors.
4. Kitchen hood fire extinguishing equipment.
5. Other dry or wet sprinkler system initiating devices.

B. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.3 TYPICAL OPERATION:

A. Actuation of any manual station, smoke detector, heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

1. Activate all programmed horn circuits.
2. Actuate strobe units until the panel is reset.
3. Light the associated indicators corresponding to active horn circuits.
4. Release all magnetic door holders, Stage Draft doors and Fire doors to adjacent zones on the floor from which the alarm was initiated.
5. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as appropriate.
6. Activation of any sprinkler system low pressure switch, on valve tamper switch, shall cause a system supervisory alarm indication.

3.4 TEST:

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
3. Verify activation of all flow switches.
4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground initiating device circuits and verify response of trouble signals.
8. Ground signaling line circuits and verify response of trouble signals.
9. Ground notification appliance circuits and verify response of trouble signals.
10. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
11. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

B. The entire fire alarm system shall be tested in accordance with NFPA standards and other applicable standards. Results of such testing shall be recorded on forms approved for the purpose, certified and submitted to the Owner's representative with final documents.

3.5 FINAL INSPECTION:

A. At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.6 INSTRUCTION:

A. Provide instruction as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.7 ZONES

A. Zones shall be identified and scheduled on the Shop Drawing Submittal using current building designations, room names and numbers.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes:
1. Excavating, filling, backfilling, grading, and compacting of earth at the site.
2. Preparation of building pad to limits shown on plans.
3. Provide and stockpile topsoil on site.
4. Dewatering excavations.

B. Related Sections:
1. Section 01 45 23 – Testing and Inspection Services
2. Section 31 10 00 - Site Clearing

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM D 698-78 Tests Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. Hammer and 12-in. Drop.
2. ANSI/ASTM D2922 - Density of Soil in Place by the Nuclear Methods.

1.04 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Submit a one gallon sample and material analysis results of imported topsoil from a testing laboratory indicating compliance with these specifications. Any topsoil delivered to the site which does not comply with the approved sample shall be re-tested at the Contractor's expense and replaced.

C. Test Reports:
1. Submit copies of test reports in accordance with SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.
2. Compaction Tests: Submit copies of compaction test reports.

1.05 QUALITY ASSURANCE

A. Laboratory Control: On site or Imported topsoil, if required, shall be inspected and tested by an independent testing laboratory.
1. Testing laboratory shall make tests of the soil from the selected source to determine that it meets the specified requirements for select fill and imported topsoil.

1.06 PROJECT CONDITIONS

A. Temporary Sheeting: Shore and sheet excavations to protect utilities and to prevent cave-in. Maintain sheeting secure until permanent construction is in place. Remove sheeting as excavations are backfilled.

B. Drainage: Provide for adequate surface drainage during construction to keep the site free of surface water without creating a nuisance in adjacent areas.

C. Pumping: Keep the excavations free of water at all times by pumping or other means. This shall be the responsibility of the Contractor regardless of the cause, source, or nature of the water.

D. Protection:
1. Property: Protect adjoining property, including improvements out-side the limits of the work. Protect walks, curbs, and paving from damage by heavy equipment and trucks.
2. Protect benchmarks.
3. Protect above and below grade utilities which are to remain.
4. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Monitor shoring system and surrounding ground surface

during construction to detect movement. If movement becomes significant, take contingency steps to brace excavation and adjacent utility lines.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil

1. Strip topsoil from limits of grading areas, clean of grass, roots, rock and debris to a depth of 12", and stockpile for placement on all landscape and "open space" areas. Contractor shall investigate the site to his satisfaction to determine if suitable material is available on site to meet the specification for topsoil.
2. Refer to landscape architect plans and specifications for additional topsoil requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.

B. Set required lines and grades using a licensed surveyor.

C. Maintain bench marks, monuments and other reference points.

3.02 PREPARATION

A. Before starting excavation, establish location and extent of underground utilities occurring in work area.

B. Notify utility companies sufficiently in advance to remove and relocate lines which are in way of excavation.

C. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.

D. Protect and support utility services uncovered by excavation.

E. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.

F. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record Documents.

G. Upon discovery of unknown utility or concealed condition, discontinue affected work and notify Architect.

H. Remove grass, weeds, roots and other vegetation from areas to be excavated, filled and graded. Fill stump holes and like small excavations with suitable material placed in lifts and thoroughly tamped.

I. Scarify the subgrade soil of pavement areas to a minimum depth of 6 inches, water and recompact. Compact to at least 95% Standard Proctor in accordance with ASTM D698 (Standard Proctor), at a moisture content of -1 to +3 percentage points of the soil's optimum moisture content.

J. Scarify general subgrade soils in place to a depth of 6 inches and compact clay soils (PI equal to or greater than 25) to a dry density between 93 and 98 percent of Standard Proctor within the range of 2 to 6 percentage points above optimum. Compact clays with a PI below 25 to a dry density of at least 95 percent of Standard Proctor within the range of 1 percentage point below to 3 percentage points above optimum. Compact non-plastic granular materials (sand) to at least 95 percent of Standard Proctor and at a moisture content within -2 to +1 percentage points of optimum.

3.03 EXCAVATION

A. General: Excavate to the lines, grades and sections shown on the drawings. Allow space for the construction of forms. **All excavation shall be unclassified as required regardless of the condition or type of material encountered, including rock.**
   1. Cut areas accurately to the indicated cross-sections and grades. Take care to prevent excavation below the grades indicated. Any bottoms and slopes that are undercut shall be backfilled with earth fill and compacted.
   2. Finish the excavating required for graded areas and building pad to a tolerance of one inch above or below the rough grade.

3. Remove underground obstructions except for piping and conduit which shall be handled as specified in SECTION 01 11 00 - SUMMARY OF WORK.

B. Over cut planting and lawn areas to allow a layer of topsoil not less than 8" thick.

C. Maintain excavations to drain and be free of excess water. Ponding of water on site will not be permitted.

D. Exercise extreme care in grading around existing trees. Do not disturb existing grades around existing trees except as otherwise noted. When excavation through roots is necessary, and after review by Landscape Architect, perform by hand and cut roots with sharp axe, prune trees to compensate for root loss.

E. Fill over-excavated areas under structure bearing surfaces in accordance with Architect's direction.

F. Do not allow construction equipment to create "pumping" of soils.

G. Stockpile excavated clean fill for reuse where directed. Remove excess or unsuitable excavated fill from site.

H. Over excavate existing soils in saturated conditions. Stockpile wet material. Allow drying out to take place. Mix stockpiled materials with relatively dry onsite material before recompacting.

3.04 WASTING

A. Surplus excavated material not suitable or required for embankment fill and backfill shall be wasted off site.

3.05 FILL AND BACKFILL

A. Filling: Construct compacted fills to the lines, grades and sections shown on the drawings.
1. Complete stripping and wasting operations in advance of fill construction. Proof roll, compact, and establish moisture content.
2. Deposit and mix fill material in horizontal layers not more than 8" deep, loose measurement. Manipulate each layer until the material is uniformly mixed and pulverized.
3. Fill material shall have moisture content to at least +3 percentage points above its optimum moisture content and compacted to a range between 93% and 98% Standard Proctor (ASTM D698), to achieve specified compaction. If fill is too wet, dry by aeration to achieve desired moisture content. If fill is too dry, add water and mix in by blading and discing to achieve desired moisture content.
4 Exercise care to prevent movement or breakage of walls, trenches, and pipe during filling and compaction. Place fill near such items by means of light equipment and tamp with pneumatic or hand tampers.
5. Proof roll exposed subgrade in building and paving areas with heavily loaded dump truck (25 ton minimum) or similar acceptable construction equipment, to detect unsuitable soil conditions. Commence proof rolling operations after a suitable period of dry weather to avoid degrading acceptable subgrade surfaces. Make four passes over each section with proof rolling equipment, with the last two perpendicular to the first two.
6. Cut out soft areas of subgrade not readily capable of in- situ compaction. Backfill and compact to density equal to requirements for subsequent backfill material.

B. Backfilling: Construct compacted fill against and around concrete beams below finish grade.
1. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.
2. Do not backfill until underground construction has been inspected, tested and approved, forms removed, and the excavations cleaned of trash and debris.
3. Bring backfill to required grades by depositing material in horizontal layers not more than 10" deep, loose measurement.
4. Site backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.
5. Maintain optimum moisture content of backfill materials to attain required compaction density.
6. Make gradual changes in grade. Blend slopes into level areas.

3.06 COMPACTION

A. Compact each layer of earth fill and backfill to the compaction and density specified.
1. Scarify the subgrade soil of pavement areas to a minimum depth of 6 inches, water and recompact. Compact to at least 95% Standard Proctor in accordance with ASTM D698 (Standard Proctor), at a moisture content of -1 to +3 percentage points of the soil’s optimum moisture content. Scarify general subgrade soils in place to a depth of 6 inches and compact clay soils (PI equal to or greater than 25) to a dry density between 93 and 98 percent of Standard Proctor within the range of 2 to 6 percentage points above optimum. Compact clays with a PI below 25 to a dry density of at least 95 percent of Standard Proctor within the range of 1 percentage point below to 3 percentage points above optimum. Compact

non-plastic granular materials (sand) to at least 95 percent of Standard Proctor and at a moisture content within -2 to +1 percentage points of optimum.

2. Equipment for compacting shall be sheeps foot and rubber tired rollers or other compactors capable of obtaining the required density. Compact the fill with power tampers and by hand in areas not accessible to rollers.
3. Compact each layer of fill to the density listed below as a function of the location. The required density in each case is indicated as a percentage of the maximum dry unit weight determined using the standard compaction test ASTM D 698.
   a. Material under paving----------95%
   b. Material under lawn areas----------93% to 98% (Clay Soils) (PI ≥ 25)
      95% min. (Calcareous Clays or Sandy Clay) (PI < 25)
      95% min. (Non-plastic granular material-sand)
   c. Material under building----------Per Geotechnical Report

3.07 GRADING

A. Site Grading: Shape and finish earthwork to bring the site to the finish grades and elevations shown on the drawings.
   1. Establish grades by means of grade stakes placed at corners of units, at abrupt changes of grade, and elsewhere as may be required.
   2. Rough grade for paving, and site improvements to the subgrade elevations required. Soft and unstable material which will not readily compact when rolled or tamped shall be removed and the resulting depressions filled with stable material and re-compacted.
   3. Finish grade to the finish contours and spot grades shown. Extend cuts and fills to feather out beyond the last finish contour or spot grade shown. Grade to uniform levels and slopes between points for which elevations are given, round off abrupt changes in elevation, and finish off smoothly. Finish grades shall slope away from the building in all directions to assure proper drainage.
   4. Execute erosion control measures in accordance with the Erosion Control Plan.

B. Grading Around Trees: Where grading is required within the branch spread of trees that are to remain, perform the work as follows:
   1. When trenching occurs, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by hand digging.
   2. When the existing grade at a tree is below the new finished grade, and fill not exceeding 6" is required, clean washed gravel graded from 1" to 2" size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of 18" and finish approximately 2" above the finished grade at the tree. Install gravel before earth fill is placed.
   3. Trees in areas where the new finished grade is to be lowered shall have re-grading work done by hand to elevation as indicated. Existing grades immediately surrounding the trunk shall not be altered except at the direction of the Architect.

3.08 PROTECTION, CLEAN-UP AND EXCESS MATERIALS

A. Protect grades from construction and weather damage, washing, erosion and rutting, and repair such damage that occurs.

B. Correct any settlement below established grades to prevent ponding of water.

C. At locations where concrete or other foreign matter has penetrated or been mixed with earth, remove damaged earth and replace with clean material.

D. Remove excess stockpiled material, debris, waste, and other material from site and leave work in clean finished condition for final acceptance. Contractor is responsible for disposal of debris and excess materials.

3.09 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the select fill material under the building pad and paving shall be performed by an Independent Testing Laboratory.
   1. Testing laboratory shall make one in place density test for each 5000 sq. ft. of area per lift in general site areas, but in no case less than two tests to ensure that the specified density is obtained. For tennis courts, ball fields, track, practice fields and competition field, the testing laboratory shall make one in place density test for each 3000 sq. ft. of area per lift, but in no case less than three tests to ensure that the specified density is obtained.
   4. The cost of the full-time inspection service shall be per Specification SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

3.10 CONSTRUCTION STAKING

A. All drives must be staked using the profiles provided in the plans in addition to the grading and dimensional control plans. The contractor shall stake all vertical curves and points of grade break in order to achieve a smooth and uniform grade throughout. Verify all grades and elevations to confirm that ADA parking spaces, walks and ramps are per plans.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supply General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes: Clearing the site of vegetation, site improvements and obstructions to make way for new work.

B. Related Sections
1. Section 31 00 00 - Earthwork.

1.03 PROJECT CONDITIONS

A. Existing Conditions: Site is generally vacant, covered with some trees and native vegetation. Contractor shall visit the site and verify the nature and extent of clearing work required.

B. Protection: Contractor shall be responsible for the protection of adjoining property and improvements outside the limits of the work. Protect paving and utilities from damage by equipment and trucks.

C. It shall be the responsibility of the Contractor to obtain a temporary water meter and temporary sanitary sewer facilities for use during construction.

D. Contractor shall exercise care during operations to confine dust to the immediate work area and shall employ dust control measures to ensure adequate dust control throughout demolition and construction operations.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable building code for disposal of debris.

B. Coordinate clearing Work with previous owner and utility companies.

C. Conform to applicable portions of OSHA, including 1926.604.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are tagged or identified

B. Locate and identify all paving and utilities intended to remain. Contractor shall field verify and coordinate with Owner and respective facility owner the location and depth of existing active facilities/ utility lines within the construction limits and shall protect all such facilities from damage during construction operations. Damage to existing facilities to remain shall be repaired at the Contractor’s expense for re-establishing the facilities to their pre-damaged condition.

3.02 PERFORMANCE

A. Clearing:
   1. Remove trees, shrubs and other vegetation from within the area of the site where new construction is to be placed. Grub out roots to a depth of at least 18 inches below natural grade
   2. Dig out and remove buried obstructions to a depth of 24 inches below natural grade or 24 inches below the intended excavation elevation, whichever is lower. (Refer to landscape architect's plans and specifications)
   3. Remove existing trash, debris and abandoned facilities, which are to be removed from the site.
   4. Refer to SECTION 01 11 00 - SUMMARY OF WORK for handling of piping and conduit encountered below grade.
   5. Clear undergrowth and deadwood, without disturbing subsoil.
   6. Burning debris on site is not permitted.
   7. Remove debris, rock, fences, and extracted plant life from site.

B. Reference landscape plans and specifications for limits for tree removal and pruning/trimming limits.

B. Disposal:
   1. Clean up and remove from the site the stumps, logs, broken paving, rubble and debris resulting from the clearing and grubbing operations.
   2. Remove all traces of demolished items from the site work area and rough grade all areas that have been disturbed.
   3. Material to be wasted shall be legally disposed of off site, at no additional cost to Owner.
   4. Burning of combustible materials on the site will not be permitted.

3.03 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded.

B. Stockpile in a preapproved area on or near the site. Install erosion control around perimeter of stockpile.

C. Reference landscape architectural plans and specifications for additional top soil requirements.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Excavating, filling, backfilling, grading, and compacting of earth at the site.

B. Related Sections:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 31 10 00 - Site Clearing.
3. Section 31 23 13 - Building Subgrade Preparation
4. Section 31 23 33 - Trenching and Backfilling.

1.2 SUBMITTALS

A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit a one gallon sample and material analysis results of imported topsoil from a testing laboratory indicating compliance with these specifications. Any topsoil delivered to the site which does not comply with the approved sample shall be re-tested at the Contractor's expense and replaced.

B. Test Reports:
1. Submit copies of test reports in accordance with SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.
2. Submit copies of test reports for select fill material. No select fill material shall be delivered to the site until after the tests have been made and test reports confirmed.
3. Compaction Tests: Submit copies of compaction test reports.

1.3 QUALITY ASSURANCE

A. Laboratory Control: Select fill material and imported topsoil, if required, shall be inspected and tested by an independent testing laboratory.
1. Testing laboratory shall make tests of the soil from the selected source to determine that it meets the specified requirements for select fill and imported topsoil.

1.4 PROJECT CONDITIONS

A. Temporary Sheeting: Shore and sheet excavations to protect utilities and to prevent cave-in. Maintain sheeting secure until permanent construction is in place. Remove sheeting as excavations are backfilled.

B. Drainage: Provide for adequate surface drainage during construction to keep the site free of surface water without creating a nuisance in adjacent areas.

C. Pumping: Keep the excavations free of water at all times by pumping or other means. This shall be the responsibility of the Contractor regardless of the cause, source, or nature of the water.

D. Protection:
1. Property: Protect adjoining property, including improvements out-side the limits of the work. Protect walks, curbs, and paving from damage by heavy equipment and trucks.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Topsoil:
1. Topsoil on the building and paving site areas shall be stripped, cleaned of grass, roots and debris to a depth of between 4" to 6", and stockpiled for later use.

2. Imported topsoil shall be required where scheduled and as required to achieve a minimum 6" depth planting bed for all lawn areas.
   a. Contractor shall haul and place imported topsoil obtained from off-site sources as necessary to construct the topsoil layer and various other details of the construction drawings. All costs related to such imported topsoil fill will be included in the contract price, and no additional or separate payment for imported fill will be due the Contractor.
   b. Topsoil shall be secured from an approved off-site location. It shall be fertile, friable, natural loam containing a liberal amount of humus and shall be capable of sustaining vigorous plant growth. It shall be free of stone lumps, clods of hard earth, plants or their roots, sticks, and other extraneous matter. Under no circumstances will topsoil be accepted unless it is free of the aforementioned contaminants. Contractor may use approved means of treating the topsoil to ensure its acceptability. Imported topsoil shall be rock free.
   c. The soil texture shall be classified as loam or sandy loam according to the "soil triangle" published by the United States Agriculture Department and the following criteria:
      1) Sand (2.0 to 0.05 mm dia.)(No. 10 sieve): Loam 25-50%; Sandy Loam 45-85%.
      2) Silt (0.05 to 0.002 mm dia.)(No. 270 sieve): Loam 30-50%; Sandy Loam less than 50%.
      3) Clay (smaller than 0.002 mm dia.)(Hydrometer Analysis): Sandy Loam less than 50%.
      4) Natural organic content: Not less than 1.5%.
      5) pH of Soil: Not more than 7.6.
      6) Soil texture shall be determined by utilizing processes as prescribed in ASTM D 422 using the No. 10 and No. 270 sieves and a hydrometer analysis.
3. Unsuitable Materials: Topsoil or unclassified fill will be declared as "unsuitable" by the Architect if, in his opinion, any of the following conditions or matter and particles are present to a degree that is judged detrimental to the proposed use of the material:
   a. Moisture.
   b. Decayed or un-decayed vegetation.
   c. Hardpan clay, heavy clay, or clay balls.
   d. Rubbish.
   e. Construction rubble.
   f. Sand or gravel.
   g. Rocks, cobbles, or boulders.
   h. Cementitious matter.
   i. Foreign matter of any kind.
4. Unsuitable materials shall be disposed of as "waste" as specified in SECTION 31 10 00 - SITE CLEARING.
5. Wet Material: If fill material is unsatisfactory for use as embankment solely because of high moisture content, the Architect may grant the Contractor permission to process the material to reduce the moisture content to a usable optimum condition.

B. Unselected Earth Fill: Clean, sandy soil free of organic matter and refuse, roots, clay lumps and rocks larger than 2".

C. Granular Fill: Clean gravel or crushed rock graded to produce a mixture passing 1¾" sieve and retained on ¼" sieve. Granular fill for areas to be covered with membrane waterproofing shall be clean pea gravel graded no larger than ¾".

D. Free-Draining Fill: Coarse sand or sand and gravel mixture with less than 12% passing a No. 200 sieve, and a Plasticity Index less than 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.

B. Set required lines and levels.

C. Maintain bench marks, monuments and other reference points.

3.2 PREPARATION

A. Before starting excavation, establish location and extent of underground utilities occurring in work area.

B. Notify utility companies to remove and relocate lines which are in way of excavation.

C. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.

D. Protect and support utility services uncovered by excavation.

E. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.

F. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record Documents.

G. Upon discovery of unknown utility or concealed condition, discontinue affected work and notify Architect.

H. Remove grass, weeds, roots and other vegetation from areas to be excavated, filled and graded. Fill stump holes and like small excavations with suitable material placed in lifts and thoroughly tamped.

I. Scarify the subgrade soil in place to a depth of 6" and compact to between 95 and 100 percent of Standard Density, at or above optimum moisture content, in accordance with ASTM D 698.

3.3 EXCAVATION

A. General: Excavate to the lines, grades and sections shown on the drawings. Allow space for the construction of forms. Excavate as required regardless of the condition or type of material encountered.
   1. Cut areas accurately to the indicated cross-sections and grades. Take care to prevent excavation below the grades indicated. Any bottoms and slopes that are undercut shall be backfilled with earth fill and compacted.
   2. Finish the excavating required for graded areas to a tolerance of 0.10 foot above or below the rough grade.
   3. Remove underground obstructions except for piping and conduit which shall be handled as specified in SECTION 01 11 00 - SUMMARY OF WORK.

B. Overcut planting and lawn areas to allow a layer of topsoil not less than 6" thick.

C. Maintain excavations to drain and be free of excess water. Ponding of water on site will not be permitted.

D. Exercise extreme care in grading around existing trees. Do not disturb existing grades around existing trees except as otherwise noted. When excavation through roots is necessary, and after review by Architect, perform by hand and cut roots with sharp axe.

E. Fill over-excavated areas under structure bearing surfaces in accordance with Architect's direction.

F. Do not allow construction equipment to create "pumping" of soils.

G. Stockpile excavated clean fill for reuse where directed. Remove excess or unsuitable excavated fill from site.

3.4 WASTING

A. Surplus excavated material not suitable or required for embankment fill and backfill shall be wasted off site.

3.5 FILL AND BACKFILL

A. Filling: Construct compacted fills to the lines, grades and sections shown on the drawings.
   1. Complete stripping and wasting operations in advance of fill construction.
   2. Deposit and mix fill material in horizontal layers not more than 8" deep, loose measurement. Manipulate each layer until the material is uniformly mixed and pulverized.
   3. Fill material shall have a moisture content at or slightly above optimum, to achieve specified compaction. If fill is too wet, dry by aeration to achieve desired moisture content. If fill is too dry, add water and mix in by blading and discing to achieve desired moisture content.

4. Exercise care to prevent movement or breakage of walls, trenches, and pipe during filling and compaction. Place fill near such items by means of light equipment and tamp with pneumatic or hand tampers.

B. Backfilling: Construct compacted fill against and around items below finish grade.
1. Do not backfill until underground construction has been inspected, tested and approved, forms removed, and the excavations cleaned of trash and debris.
2. Do not backfill against items until all of the permanent supports and bracing members are in place or until adequate shoring has been erected to prevent displacement and deflection under horizontal load. Exercise care in the placing and compacting of backfill so as not to damage the structure in any way.
3. Bring backfill to required grades by depositing material in horizontal layers not more than 8" deep, loose measurement.
4. If subgrade membrane waterproofing over concrete is installed, the Architect shall inspect the waterproofing before any backfill is placed. Do not puncture or otherwise damage the waterproofing while backfilling.

C. Retaining Wall Backfilling:
1. Place free-draining backfill in maximum eight (8) inch lifts and compact to a density ranging between 90 and 95 percent of Standard Proctor Density (ASTM D 698) at or slightly above optimum moisture. Do not over-compact backfill. Hand operated tampers or other light-weight compactors are preferred.
2. Uppermost 12" to 18" of backfill material shall consist of sandy clay with a Liquid Limit in the range of 35 to 50, a Plasticity Index in the range of 20 to 30, and the amount passing a No. 200 sieve greater than 50 percent.

3.6 COMPACTION

A. Compact each layer of earth fill and backfill thoroughly and evenly until there is no evidence of further compaction and a solid and uniform density is secured.
1. Equipment for compacting shall be sheepsfoot and rubber tired rollers or other compactors capable of obtaining the required density. Compact the fill with power tampers and by hand in areas not accessible to rollers.
2. Compact each layer of fill to the density listed below as a function of the location. The required density in each case is indicated as a percentage of the maximum dry unit weight determined using the standard compaction test ASTM D 698.
3. Compact select fill at perimeter grade beams to the density listed below at a moisture content between optimum and 4 percentage points above optimum (0 to +4).

a. Material under paving----------95 to 100%.
b. Material under lawn areas----------85 to 90%.

3.7 GRADING

A. Site Grading: Shape and finish earthwork to bring the site to the finish grades and elevations shown on the drawings.
1. Establish grades by means of grade stakes placed at corners of units, at abrupt changes of grade, and elsewhere as may be required.
2. Rough grade for walks, paving, and site improvements to the subgrade elevations required. Soft and unstable material which will not readily compact when rolled or tamped shall be removed and the resulting depressions filled with stable material and re-compacted.
3. Finish grade to the finish contours and spot grades shown. Extend cuts and fills to feather out beyond the last finish contour or spot grade shown. Grade to uniform levels and slopes between points for which elevations are given, round off abrupt changes in elevation, and finish off smoothly. Finish grades shall slope away from the building in all directions to assure proper drainage.

B. Grading Around Trees: Where grading is required within the branch spread of trees that are to remain, perform the work as follows:
1. When trenching occurs, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by hand digging.
2. When the existing grade at a tree is below the new finished grade, and fill not exceeding 6" is required, clean washed gravel graded from 1" to 2" size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of 18" and finish approximately 2" above the finished grade at the tree. Install gravel before earth fill is placed.

3. Trees in areas where the new finished grade is to be lowered shall have re-grading work done by hand to elevation as indicated. Existing grades immediately surrounding the trunk shall not be altered except at the direction of the Architect.

3.8 PLACING TOPSOIL

A. Prior to placing topsoil, scarify subgrade to a depth of 6". Following scarification, topsoil shall be spread in one 6" thick lift. Topsoil shall be compacted to the approximate density of undisturbed soil. If there is insufficient stockpiled topsoil from on-site sources to complete the work, bring in topsoil from off-site sources as needed. After topsoil has been placed. Blade, roll lightly, and rake as required to comply with compaction tests.

B. After placement of topsoil, Contractor shall eliminate all low or hollow places that would allow water to stand or pond during rainfall or during operation of lawn irrigation systems. The area shall be free of all natural debris and shall also be free of all clods and rocks which are ¾" in size or larger.

C. Finish surfaces shall be not be more than 0.10 feet above or below established grade elevation.

D. Provide uniform roundings at top and bottom of slopes and other breaks in grade. Correct irregularities and areas where water will stand.

E. Uniformly distribute topsoil to required grades; feather back to where grades remain unchanged.

F. Finish lawn and unpaved areas to 1" below top of walk and curbs.

3.9 PROTECTION, CLEAN-UP AND EXCESS MATERIALS

A. Protect grades from construction and weather damage, washing, erosion and rutting, and repair such damage that occurs.

B. Correct any settlement below established grades to prevent ponding of water.

C. At locations where lime, concrete or other foreign matter has penetrated or been mixed with earth, remove damaged earth and replace with clean material.

D. Remove excess stockpiled material, debris, waste, and other material from site and leave work in clean finished condition for final acceptance. Contractor is responsible for disposal of debris and excess materials.

3.10 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the select fill material under paving shall be performed by an Independent Testing Laboratory.
   1. Testing laboratory shall make one in place density test for each 5000 sq. ft. of area per lift, but in no case less than two tests, and one test per 100 linear feet of backfill area adjacent to grade beams, to insure that the specified density is obtained.

END OF SECTION

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SECTION 31 23 13

BUILDING SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Excavating, filling, backfilling, grading, and compacting of earth at the building site.
   1. Building foundation shall consist of:
      a. Provide “Select Fill; Concrete Floor System” under those areas of the building to have concrete floor slab on grade (not suspended).

B. Related Sections:
   1. Section 01 45 23 - Testing and Inspection Services.
   2. Section 07 13 23 - Self-adhering Sheet Waterproofing.
   3. Section 31 10 00 - Site Clearing.
   4. Section 31 23 00 - Earthwork; Site related earthwork.
   5. Section 31 23 33 - Trenching and Backfilling.

1.2 SUBMITTALS

A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit a one gallon sample and material analysis results of imported topsoil from a testing laboratory indicating compliance with these specifications. Any topsoil delivered to the site which does not comply with the approved sample shall be re-tested at the Contractor's expense and replaced.

B. Test Reports:
   1. Submit copies of test reports in accordance with SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.
   2. Submit copies of test reports for select fill material. No select fill material shall be delivered to the site until after the tests have been made and test reports confirmed.
   3. Compaction Tests: Submit copies of compaction test reports.

1.3 QUALITY ASSURANCE

A. Laboratory Control: Select fill material and imported topsoil, if required, shall be inspected and tested by an independent testing laboratory.
   1. Testing laboratory shall make tests of the soil from the selected source to determine that it meets the specified requirements for select fill and imported topsoil.

1.4 PROJECT CONDITIONS

A. Temporary Sheeting: Shore and sheet excavations to protect utilities and to prevent cave-in. Maintain sheeting secure until permanent construction is in place. Remove sheeting as excavations are backfilled.

B. Drainage: Provide for adequate surface drainage during construction to keep the site free of surface water without creating a nuisance in adjacent areas.

C. Pumping: Keep the excavations free of water at all times by pumping or other means. This shall be the responsibility of the Contractor regardless of the cause, source, or nature of the water.

D. Protection:
   1. Property: Protect adjoining property, including improvements outside the limits of the work. Protect walks, curbs, and paving from damage by heavy equipment and trucks.
   2. Trees: Protect tops, trunks, and roots of trees on the site which are to remain. Box or fence trees vulnerable to damage during construction. Remove interfering branches with care and cover scars with tree paint. Do not permit fires, storage of materials or excavation within the branch spread of trees to remain.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Select Earth Fill; Concrete Floor System: Clean soil from a selected borrow source with a Liquid Limit less than 35 and a Plasticity Index no greater than 12.

B. Select Earth Fill; Perimeter Grade Beam: Clean soil from on site or a selected borrow source with a Plasticity Index (PI) between 20 and 25.

C. Unselected Earth Fill: Clean, sandy soil free of organic matter and refuse, roots, clay lumps and rocks larger than 2".

D. Sand: ASTM C 33; fine aggregate.

E. Granular Fill: Clean gravel or crushed rock graded to produce a passing 1¾" sieve and retained on ¼" sieve. Granular fill for areas to be covered with membrane waterproofing shall be clean pea gravel graded no larger than ¾".

F. Free-Draining Fill: Coarse sand or sand and gravel mixture with less than 12% passing a No. 200 sieve, and a Plasticity Index less than 4.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove grass, weeds, roots and other vegetation from areas to be excavated, filled and graded. Fill stump holes and like small excavations with suitable material placed in lifts and thoroughly tamped.

B. Scarify the subgrade soil in place to a depth of 6" and compact to a minimum of 95% of Standard Density, at 1 or more percentage points above optimum moisture content, in accordance with ASTM D 698.

3.2 EXCAVATION

A. General: Excavate to the lines, grades and sections shown on the drawings. Allow space for the construction of forms. Excavate as required regardless of the condition or type of material encountered.
   1. Cut areas accurately to the indicated cross-sections and grades. Take care to prevent excavation below the grades indicated. Any bottoms and slopes that are undercut shall be backfilled with earth fill and compacted.

   2. Finish the excavating required for graded areas to a tolerance of 0.10 foot above or below the rough grade.

   3. Over-excavate to provide a clearance of approximately 6", under the soffits of grade beams and slabs on void carton forms.
   4. Remove underground obstructions except for piping and conduit which shall be handled as specified in SECTION 01 11 00 - SUMMARY OF WORK.

B. Excavation for Select Fill: Under those areas of the building to have concrete floor slab on grade (not suspended), over-excavate and remove the existing soil to a depth of [3 feet] below the bottom of the building floor slab. This over-excavation shall extend to the inside face of the perimeter beams.

C. Footings: Make excavations for footings to undisturbed soil and leave the bottom bearing surface clean and smooth, accurately to indicated grade and elevation. If footing excavations are made deeper than intended, only concrete shall be used as fill to bring bottom bearing surface up to desired elevation.

3.3 WASTING

A. Surplus excavated material not suitable or required for embankment fill and backfill shall be wasted off site.

3.4 FILL AND BACKFILL

A. Filling: Construct compacted fills to the lines, grades and sections shown on the drawings.
   1. Complete stripping and wasting operations in advance of fill construction.
   2. Deposit and mix fill material in loose lifts less than 9" thick, loose measurement. Manipulate each layer until the material is uniformly mixed and pulverized.
   3. Fill material shall have a moisture content at or slightly above optimum, to achieve specified compaction. If fill is too wet, dry by aeration to achieve desired moisture content. If fill is too dry, add water and mix in by blading and discing to achieve desired moisture content.
   4. Exercise care to prevent movement or breakage or walls, trenches, and pipe during filling and compaction. Place fill near such items by means of light equipment and tamp with pneumatic or hand tampers.

B. Backfilling: Construct compacted fill against and around concrete beams below finish grade.
   1. Do not backfill until underground construction has been inspected, tested and approved, forms removed, and the excavations cleaned of trash and debris.
   2. Do not backfill against beams until all of the permanent structural concrete supports and bracing members are in place or until adequate shoring has been erected to prevent displacement and deflection of the beams under horizontal load. Exercise care in the placing and compacting of backfill so as not to damage the structure in any way.
   3. Provide “Select Earth Fill; perimeter grade beam” at backfill for grade beams and footings. Unless noted otherwise, concrete walls extending five feet or more below the outside grade shall be backfilled with sand to within two feet of finish grade. The top two feet of backfill against these walls shall be “Select Earth Fill; perimeter grade beam”.
   4. Bring backfill to required grades by depositing material in horizontal layers not more than 9" deep, loose measurement.
   5. If subgrade membrane waterproofing over concrete is installed, the Architect shall inspect the waterproofing before any backfill is placed. Do not puncture or otherwise damage the waterproofing while backfilling.
   6. Provide “Select Fill; concrete floor system” at floor system on grade.

3.5 COMPACTION

A. Compact each layer of earth fill and backfill thoroughly and evenly until there is no evidence of further compaction and a solid and uniform density is secured.
   1. Equipment for compacting shall be sheepsfoot and rubber tired rollers or other compactors capable of obtaining the required density. Compact the fill with power tampers and by hand in areas not accessible to rollers.
   2. Compact each layer of fill to the density listed below as a function of the location. The required density in each case is indicated as a percentage of the maximum dry unit weight determined using the standard compaction test ASTM D 698.
   3. Compact select fill at perimeter grade beams to the density listed below at a moisture content between optimum and 4 percentage points above optimum (0 to +4).
      a. Material under the building slab-on-grade --------- 95 to 100%
      b. Material adjacent to grade beams ---------- 93 to 98%.

3.6 GRADING

A. Grading Under Slabs:
   1. Grading Under Slabs On Grade: Shape and finish select earth fill to form the subgrade for concrete floor slabs on grade. Fine grade the areas to the proper elevations and leave the compacted surfaces smooth, without waves and ruts.

3.7 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the select fill material under the building and paving and at perimeter grade beam shall be performed by an Independent Testing Laboratory.

B. Testing laboratory shall make one in place density test for each 5000 sq. ft. of area per lift, but in no case less than two tests, and one test per 100 linear feet of backfill area adjacent to grade beams, to insure that the specified density is obtained.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
1. Excavation for piped utility material.
2. Provide necessary sheeting, shoring, and bracing.
3. Comply with Federal, State, and local trench safety requirements.
4. Prepare trench bottom with appropriate materials.
5. Dewater excavation as required.
6. Place and compact granular beds, as required, and backfill.

B. Related Work Specified in Other Sections
1. Section 31 10 00 – Site Clearing
2. Section 31 00 00 – Earthwork
3. Section 33 10 00 – Water Utilities
4. Section 33 30 00 – Sanitary Sewerage Utilities
5. Section 33 40 00 – Storm Drainage Utilities

1.03 PRECAUTIONS

A. Contractor shall determine the exact location of all utilities prior to construction.

B. Notify all utility companies when necessary to disturb existing facilities and abide by their requirements for repairing and replacing.

C. Protect all vegetation and other features to remain.

D. Protect all benchmarks and survey points.

1.04 COORDINATION

A. Where the specifications conflict with the City Water and Sewer Specification and City Standard Details for water and sewer construction, the City Details and Specifications shall govern in that order.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS (ASTM D2487)

A. Reference Sitework Details and City Standard Specifications. Reference site drainage plan and NCTCOG Specification for storm drainage.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install barriers and other devices to protect areas adjacent to construction and to provide for public safety.

B. Protect and maintain all bench marks and other survey points.

3.02 EXCAVATION TRENCHES

A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.

B. Maximum width at the crown of the pipe shall be sixteen (16") inches plus the bell diameter of the pipe, unless approved specifically by the engineer due to unusual bracing and shoring requirements. The minimum width at the crown at the pipe shall be one foot plus the pipe bell diameter.

C. Cut pavement along neat straight lines with either a pavement breaker or pavement saw.

D. Trench Depth: For water lines - sufficient to provide minimum cover of 42 inches over the top of the pipe; for sewer lines and storm drain lines - as shown on the plans or as specified.

E. Align trench as shown on the plans unless a change is necessary to miss an unforeseen obstruction. Should such a change be necessary, the as-built information shall be provided to the engineer and it shall be approved by the engineer.

F. For water pipe, the trench shall be cut six (6") inches below the bottom of the pipe. The pipe shall be embedded in six (6") inches of granular material all around.

G. For sewer pipe, excavate six (6") inches below the bottom of pipe and fill the bottom of the trench with crushed stone or as specified by the City Standard Water & Sewer Specifications.

H. Trenches for storm drainage pipe shall be excavated and backfilled as shown on the plans.

I. When unsuitable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with coarse aggregate AASHTO M-43, Size No. 2 or 3.

J. Remove rock encountered in trench excavation to a depth of six (6") inches below the bottom of the pipe barrel, backfill with an approved material, and compact to uniformly support the pipe. In no cases shall solid rock exist within six (6") inches of the finished pipeline.

K. When rock borings or soundings are provided, they are for information only and do not guarantee existing conditions. Make such investigations as deemed necessary to determine existing conditions. All trench excavation shall be considered “unclassified excavation”, with no additional compensation.

3.03 SHEETING, SHORING AND BRACING

A. All trench excavation shall be in accordance with OSHA Regulations and Texas State law.

3.04 USE OF EXPLOSIVES

A. The use of explosives on this project is strictly prohibited.

3.05 DISPOSAL OF EXCAVATED MATERIAL

A. All excess excavated material that cannot be used, or is not suitable, shall be disposed of in a manner acceptable to the Architect, at no additional cost to owner.

3.06 UNAUTHORIZED EXCAVATION

A. No excavation outside or below the proposed lines and grades shown on the plans shall be provided unless approved by the Architect / Engineer.

B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock or concrete) to insure the stability of the structure or construction involved.

3.07 REMOVAL OF WATER

A. Keep excavated areas free of water while work is in progress.

B. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

C. Discharge from dewatering activities shall not be made to any sanitary sewer system unless approved by the system operator.

3.08 OBSTRUCTIONS

A. Obstructions shown on the plans are for information only and do not guarantee their exact locations nor that other obstructions are not present. The contractor shall determine and verify the exact location of all obstructions and utilities prior to construction.

B. When utilities or obstructions are not shown on the plans but are present off the roadway at the location of the proposed pipeline route, the contractor may request to relocate the pipeline at no additional cost to the Owner in the roadway if necessary to avoid disturbing the utility or obstructions.

C. Exercise due care in excavating adjacent to existing obstructions and do not disturb same.

D. In the event obstructions are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance. The repair or replacement shall be at no cost to the Owner.

E. If desired by the utility company, pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.

F. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the contractor.

3.09 STORM SEWER BEDDING

A. Bedding for RCP/HDPE storm sewers shall be as specified in Section 501.6, 504 and 504.2.1 thru 504.2.3 of Standard Specifications for Public Works Construction, NCTCOG and site details.

3.10 GRAVITY SANITARY SEWER BEDDING

A. Always maintain proper grade and alignment during the bedding and tamping process.
   1. Any pipe dislodged during this process shall be replaced by the contractor at his expense.
   2. Dig bell holes to assure uniform support of the pipe.
   3. All bedding shall be tamped to a minimum of 95% maximum dry density.

B. Bedding for PVC Sewers:
   1. Refer to Sitework Details and City Standard Water and Sewer Specifications.
   2. Lay sewer line on six inch (6") bed of crushed stone. Place granular material to a point twelve inches (12") above top of pipe.

3.11 BEDDING FOR WATER LINES

A. The water line shall be bedded on six (6") inches of granular material in accordance with City Water and Sewer Specifications. Compact granular material to a point six inches (6") above the top of pipe.

B. Dig bell holes to assure uniform support throughout the entire length of pipe.

3.12 INITIAL BACKFILLING

A. Do not begin backfilling before checking/inspecting the grade and alignment of the pipe, the bedding of the pipe, and the joints between the pipe. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order for an inspection to be made.

B. Perform backfilling by hand, together with tamping, until fill has progressed to the top of specified embedment above the pipe.
   1. Deposit appropriate material free from lumps, clods, frozen material or stones in layers approximately eight (8") inches thick.
   2. Compact by hand, or with manually operated machine tampers actuated by compressed air or other suitable means.
   3. Use tamps and machines of a suitable type which do not crush or otherwise damage the pipe.

3.13 FINAL BACKFILLING

A. After placement of the granular embedment material has been achieved, perform final backfilling depending upon the location of the work and danger from subsequent settlement.

B. Backfilling beneath existing or proposed driveways, streets, sidewalks, parking areas or any paved area:
   1. Use granular material to backfill trenches.

2. Carefully deposit in uniform layers, not to exceed six (6") inches thick.
3. Compact each layer according to Standard Proctor density of 95 percent by rolling ramming and tamping with tools suitable for that purpose in such a manner so as to not disturb the pipe. Moisture must be within +3 percentage points of optimum during compaction.
4. At 200' intervals in the trench, clay check dams shall be installed to inhibit the piping of surface and/or subsurface water. The contractor shall compact full depth two foot (2') clay check dams at each location the trench enters or exits a pavement.
5. Jetting or ponding of native material backfill will not be allowed.

3.14 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the completed trench backfill shall be performed by an Independent Testing Laboratory.
   1. The Laboratory shall make one density test for each 150 linear feet of trench, with a minimum of 1 tests per lift.

END OF SECTION

SECTION 31 31 00

SOIL TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Application of soil chemicals for the prevention of termite infestation.

B. Related Sections:
   1. Section 07 26 00 - Vapor Retarders

1.2 SUBMITTALS

A. Product Data: For termiticide.
   1. Include the current EPA-Registered Label for termiticide products.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Work shall be performed by a licensed, reputable, pest control operator with an established record of at least five years successful experience in this work.

B. Regulatory Requirements: Application of soil treatment shall meet the requirements of regulatory organizations.
   1. Texas Department of Agriculture, Structural Pest Control Service, Austin, TX.
   2. Formulate and apply termiticides according to the EPA-Registered Label.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-registered label.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard from, signed by application and contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites for a period of 5 years from date of substantial completion. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.1 2.1 SOIL TREATMENT SOLUTION

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of Texas Department of Agriculture, Structural Pest Control Service, Austin, TX, in an aqueous solution formulated to prevent termite infestation. Solution shall include synthetic dye to permit visual identification of treated soil. Product/manufacturer; one of the following:
   Demon MAX; Syngenta
   BaseLine™ or Dragnet SFR; FMC Corp., Agricultural Products Group

B. Dilute termiticide as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION/PREPARATION

A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb termiticide, ready to receive treatment.

B. Beginning of application means acceptance of soil conditions.

C. Notify Architect and Owner at least 12 hours prior to beginning work.

3.2 APPLICATION

A. Apply termiticide to soil at metered rates, in accordance with manufacturer's instructions or as indicated below if more stringent.

B. Applying Chemicals: Apply the solution not more than 24 hours prior to placing concrete slabs and at such time as there is reasonable assurance that no rain will fall until after the slabs have been placed.

1. Vertical Barrier:
   a. Establish a vertical barrier in areas around the base of footings, foundation walls, grade beams, plumbing, piers, and backfill soil. Treat both sides of footings, walls, beams, and around all sides of pipes and piers.
   b. Apply at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of footings or the bottom of beams as each demands.
   c. Applications must be made by rodding and/or trenching in accordance with manufacturer's application instructions.
   d. Cover the treated soil with a thin layer of untreated soil or other suitable barrier such as polyethylene sheeting.
   e. Apply extra treatment to structure penetrations, pipe, ducts, expansion joints and other soil penetrations.
2. Horizontal Barrier:
   a. Establish a horizontal barrier under concrete slabs on carton forms. Apply emulsion at the rate of 1 gallon per 10 square feet of grade.
   b. Applications shall be made by a low pressure spray.
   c. If concrete slab cannot be poured over the soil the same day it has been treated, cover treated soil immediately after application with polyethylene sheeting (Section 07 26 00 - Vapor Retarders) to prevent disturbance of the termiticide barrier. This protective vapor retarder shall be removed prior to the placement of void boxes. Vapor retarder will be placed on top of the void boxes. If slab-on-grade is used, do not remove vapor retarder

C. Post signs in the areas of application warning workers that soil poisoning has been applied. Signs shall remain in place until areas are covered by other construction.

END OF SECTION

SECTION 31 32 00

SOIL STABILIZATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes: In-place lime treatment to stabilize the subgrade under concrete and asphaltic concrete pavement, and concrete walks, which parallel drives.

B. Related Sections:
1. Section 01 45 23 – Testing and Inspection Services.
2. Section 31 00 00 – Earthwork.
3. Section 32 13 13 – Concrete Paving

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM D 698-91 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3).

B. Geotechnical Report

C. TxDOT - Standard Specifications for Construction of Highways, Streets and Bridges, Texas Dept. of Highways and Public Transportation, as amended.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cem-Lime Stabilization for Paving Subgrade
1. Cem-Lime: as manufactured by Martin Marietta.

B. Soil: Upper 6" of the material in-place after the subgrade has been established, compacted, and shaped.

C. Cem-Lime: a minimum of 7% by dry soil unit weight of Cem-Lime should be used.

2.02 EQUIPMENT

A. Distributor truck or tank equipped with agitator to maintain a uniform mixture of lime and water.

PART 3 - EXECUTION

3.01 PREPARATION

A. Insure that surfaces have been brought to approximate rough grades (plus or minus 0.10 feet). Loosen and pulverize soil to a depth of 6 inches below bottom of designated paving or slab areas, including a distance of 24" outside perimeter of paving and per the paving plan/details.

3.02 PERFORMANCE - PAVING SUBGRADE

A. General: It is the primary requirement to secure a completed 6" deep subgrade of treated material containing a uniform lime mixture, free of loose areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent paving and slabs to achieve a soils Plasticity Index of not greater than 12.

B. Scarification: Excavate and scarify the material to be treated down to the secondary grade (proposed bottom of lime treatment). Wet or unstable material below the secondary grade shall be corrected by scarifying, adding lime and compacting to uniform stability. Then spread the excavated and scarified material to the desired

cross-section. Full depth of treatment shall be 6 inches and full width shall be the entire area to be paved between points and lines located a minimum of 12" beyond pavement edges and 24” beyond sidewalk edge or per the plans, whichever is greater.

C. Placing Cem-Lime: Add Cem-Lime to the scarified material in an amount equal to 7% (by dry soil unit weight). of 6" depth of compacted subgrade or as otherwise required to reduce plasticity index to 12 or less per ASTM D421. Apply lime mixed with water to form a slurry. Spread cem-lime only on that area where mixing operations can be completed during the same working day.

D. Mixing: Mix the soil and lime thoroughly with suitable road mixers or other approved equipment until a homogeneous, friable mixture is obtained free from clods and lumps. Aerate or sprinkle the mixture as necessary to secure the optimum moisture content. Necessary optimum moisture content shall be at or above optimum.

E. Curing: Allow the mixture to cure for a period of from 48 to 72 hours. During the curing period keep the material moist. During this time, the section shall not be opened to vehicular traffic.

F. Final Mixing: After the required curing time, mix the material uniformly with a rotary mixer to reduce the size of the particles so that 100% will pass a 1-3/4" sieve and 60% will pass a No. 4 sieve. Lime-soil mixture pH shall be 12.4 or greater. If not possible to attain 12.4, maximum pH attainable shall be validated by laboratory test for soil being treated.

G. Compacting: Sprinkle the mixture as required and compact by rolling and tamping to a minimum of 95% standard density, ASTM D 698, and at a moisture content of optimum or better. Correct irregularities and weak spots by scarifying, adding or removing material, and re-shaping and re-compacting. Maintain the surface of the subgrade smooth, free from undulations and ruts, and to the established lines and grades.

3.03 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the completed stabilized subgrade under paving shall be performed by an Independent Testing Laboratory.
   1. The Laboratory shall make one density test for each 5000 sq. ft. of stabilized subgrade to insure that the specified density is obtained.

END OF SECTION

SECTION 31 63 29

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Dry-installed drilled piers.
2. Slurry displacement-installed drilled piers.
3. Dry-installed or slurry displacement-installed drilled piers at Contractor's choice.

1.3 UNIT PRICES

A. Unit prices are included in Section 01 22 00 "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts and bells.
1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

C. Trial Drilled Pier: Unit price as indicated for drilled pier, including backfilling.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.

D. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

F. Field quality-control reports.

G. Other Informational Submittals:
1. Record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
1. Notify all affected parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is referenced elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Refer Section 03 20 00.

2.2 CONCRETE MATERIALS

A. Refer Section 03 30 00 and Structural General Notes.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.

B. Corrugated-Steel Pipe Casings: ASTM A 929, steel sheet, zinc coated.

2.4 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Proportion normal-weight concrete mixture as follows:
1. As indicated in Structural General Notes.

2.5 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that

cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
2. Remove water from excavated shafts before concreting.

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.

G. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.

H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.

1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
2. Vibrate top 60 inches of concrete.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Drilled piers.
2. Excavation.
3. Concrete.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.

D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.
1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
3. Compression Test Specimens: ASTM C 31; one set of four standard 6-inch x 12-inch cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
5. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top, bottom, and bell.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Levelness of bottom and adequacy of cleanout.
11. Ground-water conditions and water-infiltration rate, depth, and pumping.
12. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
13. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
14. Bell dimensions and variations from original design.
15. Date and time of starting and completing excavation.
16. Inspection report.
17. Condition of reinforcing steel and splices.
18. Position of reinforcing steel.
19. Concrete placing method, including elevation of consolidation and delays.
20. Elevation of concrete during removal of casings.
21. Locations of construction joints.
22. Concrete volume.
23. Concrete testing results.
24. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes: New concrete walks, curbs and gutters, paving, approaches, and other concrete flatwork outside the building.

B. Related Sections:
1. Section 31 00 00 - Earthwork

1.03 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

B. ACI 305 - Recommended Practices for Hot Weather Concreting.

C. ACI 306 Recommended Practices for Cold Weather Concreting.

D. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

E. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

F. ASTM C309, Type II – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

G. NCTCOG - Standard Specifications for Public Works Construction.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain materials from same source throughout.

C. City Standards: Street sidewalks, curbs and gutters, and approaches shall be constructed to meet or exceed the requirements of the City standard specifications (or NCTCOG) where the City standards are applicable.

1.05 SUBMITTALS

A. Product Data: Submit concrete mix designs in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Include data on joint filler, admixtures and curing compounds.

C. Submit manufacturer's instructions under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

D. Confirm proposed joint layout shown on plans; submit revised layout for approval prior to starting work.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place pavement when base surface or ambient temperature is less than 40 degrees F, or if base surface is wet or frozen.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cements: ASTM C 150, Type I, domestic manufacture.

B. Fly Ash: ASTM C 618, Class F or C.

C. Fine Aggregate: ASTM C 33, washed sand with a fineness modulus of between 2.50-3.00.

D. Coarse Aggregate: ASTM C 33, clean crushed stone or washed gravel. The nominal maximum particle size shall not exceed 1/5 of the narrowest dimension between forms or ¾ of the minimum clear spacing between reinforcing bars.

E. Admixture: ASTM C 494, Types "A", "D" and "E", water reducing, chloride-free admixture. Product manufacturer; one of the following:
PSI; Gifford-Hill & Co., Inc.
Pozzolith; Master Builders
Plastocrete; Sika Chemical

F. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures, equal to Master Builders "Micro Air".

G. Water: ASTM C 94, Clean and potable.

H. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

I. Formwork:
1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
2. Use flexible or curved forms for curves of a radius 100 feet or less.
3. Use forms of size and strength to resist movement during concrete placement.
4. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

J. Reinforcement:
1. Reinforcement Bars: ASTM A 615, Grade 60, deformed.
2. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs. Provide with closed sleeves at one end to allow one inch movement.
3. Tie Bars: ASTM A 615, Grade 60, deformed.
4. Bar Supports: chairs for spacing, supporting, and fastening reinforcement bars, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from plastic to support bars at the proper depth per the details.

K. Concrete shall meet the requirements specified in plans and specification. Paving shall be 5.5 sack of cement content per cubic yard with a minimum compressive strength of 4000 psi at 28 days and 3000 psi at 28 days for flatwork. (Entrained Air: 3-6%, Slump: 3-5 inches, Fly Ash Replacement – 20% max).

L. Expansion Joint Filler:
1. ASTM D 1751 preformed strips of asphalt saturated cane fiberboard for joints in standard finished flatwork (walks, curbs and gutters).
2. ASTM D 1752, Type I preformed strips of elastic sponge rubber compound for joints to be caulked with sealant and joints in architectural concrete flatwork.
3. The use of redwood expansion joints is prohibited.

M. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
Product manufacturer; one of the following:
Crafco Inc.; RoadSaver Silicone SL.
Dow Corning Corporation; 890-SL.

N. Joint Sealant Backer Rod:
1. Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates,

sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

2. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.02 MIXING AND DELIVERY

A. Measurement of concrete materials, mixing, and delivery of fresh concrete to the project shall meet the requirements of ASTM C 94. Transit-mixed concrete supplier shall have a plant with sufficient capacity and transportation facilities to assure continuous delivery at the rate required.

B. Mix concrete in accordance with ASTM C94, Alternative No. 2, or ACI 304.

C. Deliver concrete in accordance with ASTM C94.

D. Select proportions for normal weight concrete in accordance with ACI 301 Method 1. Mix not less than one minute after materials are in mixer.

E. Do not transport or use concrete after 90 minutes has expired from time of initial mixing.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade is ready to support paving and imposed loads, free of frost, smooth and properly compacted.

B. Verify gradients and elevations of base are correct, and proper drainage has been provided so that water does not stand in the area to receive paving.

C. Beginning of installation means acceptance of existing conditions

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect, Owner, and testing laboratory, minimum 24 hours prior to commencement of concreting operations.

C. Grade Control: Establish and maintain the lines and grades for concrete site work items by means of line and grade stakes. Complete any fine grading required to prepare the subgrade. Maintain the finished subgrade cushions in a satisfactory condition.

3.03 INSERTS AND ACCESSORIES

A. Make provisions for installation of inserts, accessories, anchors, and sleeves.

3.04 INSTALLATION

A. Forming: Set forms to lines and grades, and brace and secure to withstand wet concrete without deflection or leakage. Stake forms securely in position with joints keyed to prevent relative displacement. Clean and oil forms each time they are used. Refer to Section 03 11 00 for additional installation requirements.
   1. Walks: 4" and 5" thick. Surfaces shall be crowned or sloped to drain.
   2. Curbs and Gutters: As detailed.
   3. Paving, Drive Approaches: Thicken edges as required.
      a. 5" thick – Light-Duty Parking Areas Traffic (Parking Areas)
      b. 6" thick – Medium-Duty Parking Areas (Drives and Fire Lanes)
      c. 7" thick – Service Docks and Dumpster Areas

B. Reinforcing: Install reinforcing to meet the requirements of SECTION 03 20 00 - CONCRETE REINFORCEMENT. Where reinforcement is not specifically detailed, reinforce pavement with and flatwork with #3 rebars at 18" o.c. each way.

C. Concrete: Place concrete to meet the requirements of SECTION 03 30 00 - CAST-IN-PLACE CONCRETE.
   1. Place concrete in accordance with ACI 301 and 304. Deposit concrete so that specified slab thickness will be obtained with use of a vibratory screed and finishing operations. Minimize

handling to prevent segregation. Consolidate concrete by suitable means to prevent formation of voids or honeycombs. Exercise care to prevent disturbance of forms and reinforcing and damage to vapor retarder. Place concrete to lines and levels shown, properly sloped to drain into adjacent yard areas or drainage structures. **Concrete shall be placed using a walk behind screed machine (Magic Screed). In addition, a backpack vibrator shall be used. A minimum of two (2) screed machines and backpack vibrators shall be present during all concrete pours.** The surface shall be troweled and edged with a steel trowel and then broomed to obtain a smooth, uniform brush finish.

2. Hot Weather Placement: ACI 305.
3. Cold Weather Placement: ACI 306.
4. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
5. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
6. **The Contractor shall not back over the steel at anytime while pouring concrete. Construction sequencing efforts shall be utilized in order to successfully make each concrete pour. If necessary, the Contractor shall utilize concrete pumping to perform the work.**

D. Expansion Joints: Locate expansion joints around fixed objects within or abutting concrete, and at intervals of not more than 35 ft. o.c. along walks and curbs and 150 ft. o.c. along drive and parking paving unless otherwise shown on the plans.
1. Install preformed filler with the top edge approximately 1/4" below the finished concrete surface to leave a neat, straight joint.
2. Joints shall be ½" wide unless specifically dimensioned otherwise on the drawings. Joint edges shall be rounded with an edging tool.
3. There shall be no connection by reinforcement or keyway across expansion joints. Joints shall be held in alignment with sleeved, smooth dowels where required.
4. The use of redwood expansion joints is prohibited.

E. Scoring:
1. Saw cut walks, approaches, and paving using an abrasive or diamond blade. Cut joint width shall be 1/8" and depth shall be 1/4" deep at walks and 1/3 slab thickness at approaches and paving. Cutting of joints must be done as soon as concrete surface is firm enough not to be torn or damaged by the blade (within 4 to 12 hours), and before random shrinkage cracks can form in the concrete slab.

    a. Score walks at approximately 5-foot intervals each way. Where walks abut curbs, the scoring of walks and curbs shall align.
    b. Score curbs and curbs and gutters at approximately 5-foot intervals.
    c. Score approaches and paving at approximately 10-foot intervals each way or as shown.

F. Standard Finishing: Strike slabs off true by double screeding to the required level at or below the elevations and grades shown on the drawings. Set edge forms and screed strips accurately to produce the designated elevations and contours.
1. Walks: Float with wood floats to true planes with no coarse aggregate visible. Hand trowel to produce smooth surfaces. Brush surfaces with a soft fiber brush to produce a uniformly striated finish. Edge concrete surfaces with a rounded edging tool.
2. Curbs and gutters: All curbs shall be formed and finished with a preformed mechanical mule. No hand formed curbs shall be allowed except in those areas that require transitioning to a laydown curb, inlet or radii less than 4 feet. Cross brush surfaces with a soft fiber brush to produce a fine brush finish.
3. Approaches: Screed and float to a monolithic medium float finish and belt with a canvas belt to produce a herringbone texture finish.
    a. Curb Ramps: Provide tooled grooves with chemical staining of concrete as detailed.

G. Curing:
1. Cure concrete 7 days. Coat exposed surfaces with **white pigmented** curing compound and protect surfaces from pedestrian and vehicular traffic during the curing period. Damaged areas shall be re-sprayed. Curing compound shall conform to the specifications of ASTM C309, Type 2.

2. Removing Forms: Forms shall remain in place for at least 12 hours after concrete has been placed and finished. Remove forms without damaging the concrete. Bars and heavy tools shall not be used to pry against the concrete in removing the forms. Backfill all curbs.

3.05 FIELD QUALITY CONTROL

A. Concrete Tests: Testing and acceptance of concrete shall meet the requirements specified in the plans and specifications and by the geotechnical firm.

B. Grade and Smoothness Tests:
1. Plan Grade: Finished surface of the flatwork shall not vary more than 0.04 ft. above or below the plan grade or elevation. Finished surfaces of abutting pavement and walks shall coincide at their juncture. Where a new pavement or walk abuts an existing surface, transition pavement or walk strip shall be installed.
2. Surface Smoothness: Finished surface of the flatwork shall have no abrupt changes of more than 1/8" and shall not deviate from the testing edge of a 12 ft. straight edge more than 1/4" plus or minus tolerance. Flow line of gutters shall not deviate from the testing edge of a 10 ft. straight edge more than 1/8" plus or minus tolerance.

C. **Concrete Cracking:**
Contractor is responsible for controlling all concrete cracking. If more than one (1) crack per panel occurs, the Contractor may be required to remove and replace the panel as directed by the Engineer or Owner.

3.06 CLEANING

A. Remove debris, scraps, surplus materials, tools and equipment from the premises upon completion of the work. Clean concrete droppings from walks and curbs. Leave the graded areas free of debris and rubble.

3.07 PROTECTION

A. Immediately after placement, protect concrete under provisions of SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least 7 days old or has attained a minimum average of 3,000 psi compressive strength. Repair any damage to the pavement prior to the acceptance by Owner at no additional cost to the Owner. This does not relieve the Contractor from the normal liabilities, and maintenance responsibilities, implied or otherwise, for the pavement or other items.

END OF SECTION

SECTION 32 15 40

DECOMPOSED GRANITE

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Divisions 00 and 01 Specification Sections, apply to this Section.

1.02 SCOPE OF WORK

A. Furnish materials, labor, transportation, services, and equipment necessary to install decomposed granite paving as indicated on Drawings and as specified herein.

B. Work related in other Sections:

1. Section 32 84 00 Planting Irrigation

2. Section 32 93 00 Trees, Shrubs, and Groundcover:

1.03 REFERENCES

A. ASTM C 136 – Method for Sieve Analysis for Fine and Coarse.

1.04 SYSTEM DESCRIPTION

A. Decomposed granite paving

1.05 SUBMITTALS

A. In accordance with Division 01.

B. Submit specification data Cut Sheets for products specified under this Section.

C. Products: Five pound sample and sieve analysis for grading of decomposed granite material.

1.06 TESTS

A. Perform gradation of decomposed granite material in accordance with ASTM C 136.

1.07 MOCK-UPS

A. Install a 12” wide x 6' long mock-up of decomposed granite paving with compacted with a vibrating plate at location as directed by Owner’s Authorized Representative.

B. This mock-up will be the standard from which future work will be judged.

C. Mock-up may be located in area as part of final built site.

1.08 ENVIRONMENTAL CONDITIONS

A. Do not install decomposed granite paving during rainy conditions.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. In accordance with Division 01.

1.10 COORDINATION

A. Notify contractors related to installation of his work in ample time, so as to allow sufficient time for those contractors to perform their portion of work.

1.11 QUALITY ASSURANCE

A. Installer: Provide evidence to indicate successful experience in providing decomposed granite.

1. Experience: Minimum 5 years.

1.12 INSPECTION OF SITE

A. Verify conditions at site that affect Work of this Section, and take field measurements as required. Report major discrepancies between Drawings and field dimensions to Owner's Authorized Representative prior to commencing Work.

1.13 EXCESS MATERIALS

A. Provide Owner's Authorized Representative with the following excess materials for use in future decomposed granite paving repair:

1. Four, 40 lb. Bags of decomposed granite screenings with source location provided.

PART 2 – PRODUCTS

2.01 DECOMPOSED GRANITE SCREENINGS

A. Washed, natural-colored crushed granite stone, free of clay, friable materials and debris and graded in accordance with ASTM C 136 within the following limits:

1. Gradation: As determined by ASTM C 136 methodology.

Sieve Size	Percent Passing
1/2"	95 - 100
3/8"	90 - 100
No. 4	50 - 100
No. 30	25 to 55
No. 100	10 to 20
No. 200	5 - 18

2. Sand Equivalent: As determined by ASTM D-2419 methodology. Shall have a minimum of 30.

3. R-Value: As determined by ASTM D-2488 methodology. Shall have a minimum of 70.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. Verify that gradients and elevations of subgrade are correct. Ensure that a minimum of 2% of cross slope will be provided. Contact Owner's Authorized Representative if this minimum percentage will not be maintained.

B. Verify that weed barrier or plastic sheeting will extend to edge of decomposed granite paving.

C. Remove loose material from compacted subbase surface immediately before placing decomposed granite screenings.

D. Wet surface prior to placing decomposed granite screenings.

3.02 PLACEMENT OF DECOMPOSED GRANITE SCREENINGS

A. Place decomposed granite screenings in two inch lifts to a depth of four inches, applying moisture and compacting with a vibratory plate after each lift.

B. Grade and smooth decomposed granite paving per approved Owner's Authorized Representative mock-up.

C. Apply water until moisture penetrates to full depth of decomposed granite screenings. It is critical that full section of decomposed granite screenings receive water at this time.

D. Upon thorough moisture penetration, compact decomposed granite screenings to within 90% relative compaction by using a vibrating plate.

E. Take care in compacting decomposed granite screenings when adjacent planting and irrigation systems.

F. Allow the finished surface enough time to dry completely before allowing traffic.

3.03 REPAIRS AND PROTECTION

A. Remove and replace decomposed granite paving that is damaged, defective, or does not met requirements of this Section.

B. Protect decomposed granite paving from damage until Final Payment.

3.04 CLEANUP

A. Upon completion of Work under this Section, remove rubbish, waste and debris resulting from Contractor's operations. Leave work area in a neat and clean condition.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A . Section Includes: Pavement marking on Portland Cement Concrete Pavement.

B. Related Sections:
1. Section 32 13 13 - Concrete Paving

1.03 REFERENCES

A. Federal Specification (FS):
1. FS - TT-P-115E Paint, Traffic, Highway, White and Yellow.

1.04 PROJECT CONDITIONS

A. Environmental Requirements Apply paint when ambient temperature is 50°F. or above, and relative humidity is below 85%.

1.05 QUALITY ASSURANCE

A. Installer: Shall have a minimum of 2 years' experience in the layout and striping of parking lots.

B. Job Conditions: Do not apply marking paint when weather is foggy or rainy, or ambient or pavement temperatures are below 40 degrees F., nor when such conditions are anticipated during eight hours after application.

1.06 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Traffic Paint: Fed. Spec. TT-P-115E, Type III alkyd-chlorinated rubber-chlorinated paraffin marking paint. Striping colors per plans and City requirements. Provide Premium Chlorinated Rubber Base Paint as manufactured by Highway Signs & Paint, Inc. (phone 214 446-1605), or approved equivalent.

B. Cleaning Solvent: VM & P Naphtha.

2.02 EQUIPMENT

A. Applicators: Hand-operated push type marking machine or conventional airless spray equipment with guide lines and templates.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Conditions: Clean and dry free from dirt, loose paint, oil, grease, wax, and other contaminants.
1. Asphalt Surfaces: Allow asphaltic concrete to cure a minimum of 48 hours prior to application of marking paint.

B. Equipment Condition: Clean previously used paint and solvent from application equipment, using VM & P Naphtha.

C. Paint: Stir contents thoroughly from bottom of container. Do not thin paint.

D. Locate markings as indicated on Drawings. Provide qualified technician to supervise equipment and application of markings. Lay out markings using guide lines, templates and forms.

E. Allow paving to cure before painting as required by manufacturer of traffic paint.

F. Allow protective coating to cure a minimum of 48 hours prior to application of traffic paint.

3.02 APPLICATION

A. Using approved equipment, apply paint to a minimum thickness of 15 mils. Stripes shall be 4" wide. Marking edges of stripes and symbols shall be sharply outlined.

END OF SECTION

SECTION 32 19 00

WALK, ROAD, AND PARKING APPURTENANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 WORK INCLUDED

B . Provide and install handicapped parking signs and traffic directional signs.

1.03 REFERENCES

A.. American Society for Testing and Materials (ASTM):
1. ASTM A 591 Steel Sheet, Cold-Rolled, Electrolytic Zinc- Coated.
2. ASTM B 209 Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C 33 Concrete Aggregates
4. ASTM C 150 Portland Cement

B. Military Specifications (Mil. Spec.):
1. Mil. Spec. MIL-R-13689A

1.04 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include catalog, cuts of each type of sign and manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle signs in accordance with SECTION 01 65 00 – PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00- PRODUCT STORAGE AND HANDLING REQUIREMENTS and in manufacturer's cartons. Store off ground on planking. Cover with non-staining plastic.

1.06 PROJECT CONDITIONS

A. Coordinate installation of signs with work of other trades.

B. Location of signs shall be in accordance with City and State requirements. Signs shall be positioned not to conflict with automobile or pedestrian traffic.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Site signs: As manufactured by Sa-So (Sargent-Sowell, Inc.) 1185 108th Street, Grand Prairie, Texas 75050 (phone 647-1525), or approved equivalent.

2.02 MATERIALS

A. Sign Materials: Aluminum Sheets: ASTM B 209, alloy 6061 T6, degreased and etched, 0.080" thickness. Sign faces shall be fully reflectorized with material conforming to Mil. Spec. MIL-R-13689A.

B. Bolts, Nuts, Washers, and Clamps: Cadmium or galvanized steel. Bolts shall be a minimum of 5/16" in diameter. Clamps shall be two-piece assemblies of at last 14-gage steel or shall be an adjustable steel strap bracket.

C. Posts: Standard galvanized steel pipe 2-3/8" in diameter and weighing not less than 2 lbs. per linear foot.

D. Concrete: Provide concrete consisting of Portland cement (ASTM C 150), aggregates (ASTM C 33), and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3000 psi, using at least 4 sacks of cement per cubic yard, 1 inch maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

2.03 SITE SIGNS

A. General: Site signs shall be of the quality manufactured by Sa-So and are listed by Sa-So catalog numbers for convenience in identification.

B. Accessible Parking Signs: Reflective .080 Aluminum.

C. Accessible Loading Zone Sign: Reflective .080 Aluminum.

C. Traffic Signs:
1. ONE WAY Signs: Reflective sheeting on 0.080" aluminum.
2. ONE WAY - DO NOT ENTER Signs: Reflective sheeting on 0.080" aluminum.
3. STOP Signs: Reflective sheeting on 0.080" aluminum.

2.04 WHEEL STOPS

A. Anchor each unit with minimum of two 12” long x 1/2” diameter steel rods, through unit into pavement.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Excavation: Drill holes of the size indicated for posts. Excavate holes to the depths indicated. Remove excess concrete and excavated soil from the site.

B. Setting Posts:
1. Remove all loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete. Center and align posts in holes.
2. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Trowel finish tops of footings, and slope or dome to direct water away from posts.

C. Attach signs to posts with bolts, washers, nuts and clamps.

D. Clean exposed sign faces and galvanized surfaces, and leave free of defects. Use no abrasives. leave pavement and graded area clean and free of debris.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary Conditions of the Contract, Division 1 – General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SCOPE

A . Section Includes: Galvanized steel chain link fences and gates. Contractor shall obtain chain link fences as complete units, including necessary erection accessories, fittings and fastenings from a single source or manufacturer.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
0. ASTM A 153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A 392 – Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
3. ASTM A 446 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
4. ASTM A 569 – Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
5. ASTM A 641 – Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
6. ASTM A 824 – Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
7. ASTM C 33 – Specification for Concrete Aggregates.
8. ASTM C 150 – Specification for Portland Cement.
9. ASTM F 567 – Practice for Installation of Chain-Link Fence.
10. ASTM F 669 – Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.
11. ASTM F 900 – Specification for Industrial and Commercial Swing Gates.
12. ASTM F 1083 – Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

B. Chain Link Fence Manufacturer's Institute (CLFMI) Publications:
1. Product Manual

1.04 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide chain link fences and gates as manufactured by one of the following:
Allied Tube and Conduit Corp.
American Chain Link Fence Company
American Tube Company
Anchor Fence, Inc.
Capitol Wire and Fence Co., Inc.
Century Tube Corp.
Cyclone Fence Div./USX Corp.

2.02 MATERIALS

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12' high. All fencing shall have a knuckled selvage top and bottom. Wire size includes zinc coating.

a. Fabric sizes:
1. Fencing: 2-inch mesh, 0.148-inch diameter (9 gauge).

B. Galvanized Steel Finish: ASTM A 392, Class 1, with not less than 1.2 oz. Zinc per sq.ft. of uncoated wire surface.

C. Framing: Strength requirements for posts and rails shall comply with ASTM F 669.

D. Pipe shall be straight, true to section, material and sizes specified and shall conform to the following weights per foot:

NPS in Inches	Outside Diameter (OD) in inches	Type I Steel (lbs./ft.)
1 ¼	1.660	2.27
1 ½	1.900	2.72
2	2.375	3.65
2 ½	2.875	5.79
3 ½	4.000	9.11
6 ⅝	6.625	18.97

E. Steel Framework, General: Posts, rails, braces and gate frames.

1. Type I Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.

F. End, corner and pull posts: Size as indicated on the plans.

G. Line or intermediate posts: Size as indicated on the plans.

H. Top Rail: Manufacturer's longest lengths, with expansion-type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1. Galvanized Steel: 1 ¼" NPS (1.66" OD) Type I steel pipe.

I. Tension Wire: ASTM A 824, 0.177" diameter metallic-coated steel marcelled tension wire with finish to match fabric.

J. Tie Wires: 0.148-inch diameter (9 gauge) aluminum wire alloy 1350-H19 or equal.

K. Post and Line Caps: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.

L. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2" less than full height of fabric, minimum cross-section of 3/16" by ¾" and minimum 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.

M. Tension and Brace Bands: Minimum ¾" wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. Tension and Brace Bands: Minimum 12 gauge (0.105") thick.

N. Gates:

1. Gate frames shall be constructed of 2" o.d., Schedule 40 steel pipe secured at corners with malleable iron or pressed steel ells, riveted with four rivets per ell. Frame shall be hot-dip zinc coated after fabrication.
2. Welded gate frames are unacceptable.
3. Internal bracing shall be 3/8" diameter galvanized truss rods with tighteners.
4. Hinges shall be pressed steel or malleable iron. Bottom hinge shall be a ball and socket type. All gates shall allow for a one hundred eight (180˚) degree swing.
5. Gates shall be equipped with a heavy duty fork-type latch with lock keeper and lock keeper guide and as indicated on the plans.

O. Fittings: All fittings to be hot-dip zinc coated shall be 1.2 ounces of zinc per square foot of coated area.

P. Concrete Post Footings: All concrete used shall conform to Section 03 30 00 – Cast-in-Place Concrete.

PART 3 - EXECUTION

3.03 INSTALLATION

A. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed.

B. Setting Posts: Center and align posts in holes 6" above bottom of excavation. Space maximum 10' o.c. unless otherwise noted on the plans. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Extend concrete footings 2" above grade and trowel to a crown to shed water.

C. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

E. Bottom Tension Wire: Install tension wire within 6" of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 11-gage hog rings of same material and finish as fabric wire, spaced maximum 24" o.c.

F. Tension or Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to end, corner, pull and gate posts with tension bands spaced not over 15" o.c.

G. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
1. Maximum Spacing: Tie fabric to line posts 12" o.c. and to rails and braces 24" o.c.

H. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

I. Fabric: All fabric shall be placed on the inside of the baseball/softball fields, track, and tennis courts.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES & GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Ornamental welded steel fence systems.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Condition and Sections in Division 1

B. Section 31 00 00 - Earthwork.

1.03 REFERENCES

A. American Welding Society (AWS): AWS D1.1 - Structural Welding Code - Steel.

B. ASTM International (ASTM):
1. ASTM A 36 – Structural Steel
2. ASTM A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. ASTM D 822 – Tests on Paint and Related Coatings using Filtered Open Flame Carbon-Arc Exposure Apparatus
5. ASTM D 3363 – Test Method for Film Hardness by Pencil Test
6. ASTM F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

C. Code of Federal Regulation (CFR): 28 CFR Part 36 - Americans With Disabilities Act - hereinafter referred to as ADA.

D. International Code Council (ICC): ICC-ES AC174 - Deck Board, Handrails and Fence Testing.

E. International Conference of Building Officials (ICBO): ICBO UBC - Uniform Building Code.

1.04 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): 120 degrees F (49 degrees C) ambient; 180 degrees F (82 degrees C) material surfaces.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.05 SUBMITTALS

A. General: Submit under provisions of Section 01 33 23 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data: Manufacturer's printed product information indicating material compliance and specified options are to be submitted prior to installation. Submit manufacturer's data sheets on each product to be used.

C. Shop Drawings: Layout of system components with dimensions, details, and finishes shall be submitted for approval and shall be approved prior to installation. Include plans, elevations, sections, details, and attachments to other work.

D. Design Data: Submit design data to verify compliance design loads specified in Performance Requirements Article. Design data shall be signed and sealed by the qualified professional engineer responsible for their preparation.

E. Samples:
1. Submit samples for initial color selection. Submit samples of each specified finish. Submit samples in form of manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full, range of variations expected.
2. Submit samples for verification purposes. Samples shall be submitted prior to installation. Submit samples for the following:
a. For each type of exposed finish required.
b. Of each distinctly different linear railing member.

F. Certificates:
1. Mill certificates signed by manufacturers of steel products certifying that products furnished comply with requirements.
2. Welding certificates.

G. Qualification Data: For professional engineer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified inspecting and testing agency, according ASTM E 935.

I. Closeout Submittals: Operation and maintenance data.

1.06 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Company engineering and fabrication of custom fencing and gate systems for a minimum of 15 years.
2. Installer Qualifications: Company experienced in manufacturer's products for a minimum of 5 years. The Contractor shall provide trained laborers with prior experience in the type of construction involved as well as experience installing the materials and techniques specified.
3. Qualified Professional Engineer: A professional engineer licensed in the state of the Project location and who is qualified to design the portion of the work described in this Section.

B. Regulatory Requirements: Completed installations shall meet ICBO UBC standards, applicable requirements of ADA Accessibility Guidelines along with any local amendments and/or modifications. Completed installations shall also conform to applicable state, regional, and local codes and regulations.

C. Source Limitations: Obtain each type of system through one source from a single manufacturer.

D. Modifications: Do not modify intended aesthetic effects as judged solely by the Architect, expect with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.

E. Welding: Qualify procedures and personnel according to AWS D1.1.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provision of section – Product Storage & Handling Requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store components in a dry, sheltered location away from uncured concrete, masonry, mortar, and stucco; and a safe distance away from any sanding, blasting, welding and/or painting operations.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with fencing and gates by field measurements before fabrication and indicate measurements on shop drawings. Provide allowance for trimming and fitting at site.

1.09 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for fencing and gates. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to the Project Site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support systems temporarily by any means that do not satisfy structural performance requirements.

1.10 WARRANTY

C. Provide manufacturer's standard 10 year limited warranty, from the date of purchase, against defects in materials and workmanship including protection against cracking, peeling, blistering, and corrosion (rusting).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

a. Ameristar Fence Products, Inc. which is located at Tulsa, Oklahoma

B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 66 00 - Product Requirements.

2.02 MANUFACTURED UNITS

A. Ornamental Welded Steel Fence Systems:

1. Product:
   a. Montage II Majestic as manufactured by Ameristar Fence Products, Inc. or
   b. Approved Equal
2. Materials: per manufacturer’s recommendations.
3. Components:
   a. Rails: per manufacturer’s recommendations – 2 rail top, 1 rail bottom
   b. Pickets: per manufacturer’s recommendations
   c. Posts: per manufacturer’s recommendations
   d. Fasteners: Nuts, bolts, sheet metal screws, and wood screws shall be stainless

steel conforming to ASTM F 593.

e. Fittings: Fabricated tees, elbows, splice connections, wall returns, wall ends and other similar components shall be of the same material, specification, and finish as fence panels.

4. Fabrication:
   a. Fence panels shall be fabricated in standard length per manufacturer's recommendations.
   b. Welded connections shall comply with AWS standards for recommended practice in shop welding.
   c. Components shall be accurately cut and drilled to receive hardware, fasteners, and accessories.
5. Finish:
   a. Metal parts shall be assembled and finished individually prior to shipment.
   b. Galvanized steel fence components shall be cleaned with a non-petroleum solvent followed by the application of a sealing zinc phosphate coating.
   c. Immediately after sealing, a two-step powder finish coating shall be applied by the electrostatic spray process. This shall consist of a thermosetting carboxyl polyester resin top coat with a minimum dry film thickness of 60 microns to 70 microns.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.02 PREPARATION

A. Stake layout showing locations of gates and posts. Contact applicable authorities and take necessary precautions prior to beginning any excavation work.

B. All new installation shall be laid out by the contractor in accordance with the construction plans. Prior to fabrication, field verify required dimensions.

3.03 INSTALLATION

A. Install fences in accordance with manufacturer's written instructions. Installation shall conform to the specifications referenced elsewhere in this Section and as indicated on the Drawings. Fence posts shall be set in concrete footers having a minimum depth of 36" with a minimal diameter of 12". Fence posts shall be spaced in accordance with manufacturer's recommendation to accommodate installation of brackets as necessary. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer with approved fasteners and techniques to ensure fences sections are parallel to grade.

B. Gate Installation: Install in accordance with manufacturer's printed instructions. Gate posts shall be spaced according to manufacturer's gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. The manufacturer's gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendation. Do not mount gate from wall of a structure. Provide gate post on both sides of a gate. For double drive gate installation, provide concrete center drop to foundation depth and drop rod retainers at center. Lubricate to ensure smooth operation and verify proper latch operation. Provide panic hardware and door closer hardware at all gate location as shown on the plans and match existing.

3.04 CLEANING

A. Remove cutting and drilling chips that are attached to the fencing, post, brackets, or additions to prevent corrosion.

B. Repair scratches and other installation-incurred damage. Repair areas per manufacturer's recommendation using a spray paint of the appropriate color that shall include a zinc additive, repaint and seal any scratches or holes drilled in the fencing, post, brackets, or additions to prevent rust from forming.

C. Clean up debris and unused material, and remove from site.

3.05 PROTECTION

A. Protect finishes from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 32 32 23
MODULAR RETAINING WALL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work shall consist of furnishing and construction of a Keystone Century Retaining Wall System or approved equal, in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.

B. Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.

C. Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

1.02 RELATED SECTIONS

A. Section 311000- Site Clearing
B. Section 310000 - Earthwork

1.03 REFERENCE DOCUMENTS

A. American Society for Testing and Materials (ASTM)

1.	ASTM C-1372	Specification for Segmental Retaining Wall Units
2.	ASTM D-422	Particle Size Analysis
3.	ASTM D-698	Laboratory Compaction Characteristics of Soil -Standard Effort
4.	ASTM D-4318	Liquid Limit, Plastic Limit and Plasticity Index of Soils
5.	ASTM D-4595	Tensile Properties of Geotextiles - Wide Width Strip
6.	ASTM D-5262	Unconfined Tension Creep Behavior of Geosynthetics
7.	ASTM D-3034	Polyvinyl Chloride Pipe (PVC)
8.	ASTM D-1248	Corrugated Plastic Pipe
9.	ASTM D-4475	Horizontal Shear Strength of Pultruded Reinforced Plastic Rods

B. Geosynthetic Research Institute (GRI)

1.	GRI-GG4	Determination of Long Term Design Strength of Geogrids
2.	GRI-GG5	Determination of Geogrid (soil) Pullout

C. National Concrete Masonry Association (NCMA)

1. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW
2. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

1.04 SUBMITTALS/CERTIFICATION

A. Contractor shall submit a Manufacturer's certification, prior to start of work, that the retaining wall system components meet the requirements of this specification and the structure design.

B. Contractor shall submit construction drawings and design calculations for the retaining wall system prepared and stamped by a Professional Engineer registered in the state of the project. The engineering designs, techniques, and material evaluations shall be in accordance with the Manufacturer’s Design Manual, NCMA Design Guidelines For Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable to designer).

C. Contractor shall submit a test report documenting strength of specific modular concrete unit and geogrid reinforcement connection. The maximum design tensile load of the geogrid shall be equal to the laboratory tested ultimate strength of geogrid / facing unit connection at a maximum normal force limited by the “Hinge Height” of the structure divided by a safety factor of 1.5. The connection strength evaluation shall be performed in accordance with NCMA test method SRWU-1.

1.05 QUALITY ASSURANCE

A. Contractor shall submit certification, prior to start of work, that the retaining wall system (modular concrete units with fiberglass pins and specific geogrid):

1) Has been successfully utilized on a minimum of five (5) similar projects, i.e., height, soil fill types, erection tolerances, etc.; and

2) Has been successfully installed on a minimum of 1 million (1,000,000) square feet of retaining walls.

B. Contractor shall submit a list of five (5) previously constructed projects of similar size and magnitude by the wall installer where this retaining wall system has been constructed successfully. Contact names and telephone numbers shall be listed for each project.

C. Contractor shall provide evidence that the design engineer has a minimum of five years of documental experience in the design for reinforced soil structures. The design engineer shall provide proof of current professional liability insurance with an aggregate coverage limit of not less than $2,000,000.

D. Owner shall/may provide soil testing and quality assurance inspection during earthwork and wall construction operations. Contractor shall provide any quality control testing or inspection not provided by the Owner. Owner's quality assurance program does not relieve the contractor of responsibility for quality control and wall performance.

1.06 DELIVERY, STORAGE AND HANDLING

A. Contractor shall check all materials upon delivery to assure that the proper type, grade, color, and certification have been received.

B. Contractor shall protect all materials from damage due to jobsite conditions and in accordance with manufacturer's recommendations. Damaged materials shall not be incorporated into the work.

PART 2 - PRODUCTS

2.01 DEFINITIONS

A. Modular Unit - a concrete retaining wall element machine made from Portland cement, water, and aggregates.

B. Structural Geogrid - a structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.

C. Unit Drainage Fill - drainage aggregate, which is placed within and immediately behind the modular concrete units.

D. Reinforced Backfill - compacted soil, which is placed within the reinforced soil volume as outlined on the plans.

2.02 MODULAR CONCRETE RETAINING WALL UNITS

A. Modular concrete units shall conform to the following architectural requirements:

1. Face color - The Owner, as indicated on the plans, may specify standard manufacturers' color or color blend.
2. Face finish - "weathered" rock face. Other face finishes will not be allowed without written approval of Owner.
3. Bond configuration – randomly utilize the various shapes to avoid repetition of the same unit size. Avoid stack bonding of unit joint for more than two courses vertically.
4. Exposed surfaces of units shall be free of cracks or major imperfections when viewed from a distance of 10 feet under diffused lighting. Chips and imperfections are expected with the

"weathered" rock face texture and are acceptable unless adversely affecting installation or structural performance.

B. Modular concrete materials shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.

C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with appropriate references:

1. Compressive strength: ≥ 3000 psi minimum (21 MPa);
2. Absorption: ≤ 8% (6% in northern states) for standard weight aggregates;
3. Dimensional tolerances: ± 1/8" (3 mm) from nominal unit dimensions not including rough split face, ±1/16" (1.5 mm) unit height - top and bottom planes;
4. Unit size: 8" (203 mm)(H) x 12" (304 mm)(D) minimum; width of units varies from 7" to 18" (175 mm to 457 mm). Three or four unit sizes are typically available.
5. Unit weight: 35 lbs to 90 lbs (15 kg to 40 kg) per unit;
6. Inter-unit shear strength: 600 plf (8 kN/m) minimum at 2 psi (13 kPa) normal pressure;
7. Geogrid/unit peak connection strength: 500-plf (7 kN/m) minimum at 2-psi (13 MPa) normal force.

D. Modular concrete units shall conform to the following constructability requirements:

1. Vertical setback = vertical (tilt wall back slightly to achieve positive batter) or 1" (25 mm) + per course per the design;
2. Alignment and grid positioning mechanism - fiberglass pins, one for each pin placement series or a minimum of one pin per unit;
3. Maximum horizontal gap between erected units shall be ≤ 1/2 inch (13 mm).

2.03 SHEAR CONNECTORS

A. Shear connectors shall be 1/2-inch (12 mm) diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically adjacent units. Pins shall be 5 1/4" (130 mm) long and capped with a 3/4" (19 mm) diameter "shoulder". Strength of shear connectors shall be a minimum of 6400 psi (44 MPa) per ASTM D-4475 and shall be applicable over a design temperature of 10 degrees F to + 100 degrees F (-10 to 40 degrees C).

B. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.04 BASE LEVELING PAD MATERIAL

A. Material shall consist of a compacted crushed stone base or non-reinforced concrete as shown on the construction drawings.

2.05 UNIT DRAINAGE FILL

A. Unit drainage fill shall consist of clean 1" (25 mm) minus crushed stone or crushed gravel meeting the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing
1 inch (25 mm)	100
3/4-inch (19 mm)	75-100
No. 4	0 - 10
No. 50	0 - 5

B. One cubic foot (0.028 m3), minimum, of drainage fill shall be used for each square foot (0.093 m2) of wall face. Drainage fill shall be placed within cores of, between, and behind units to meet this requirement.

2.06 REINFORCED BACKFILL

A. Reinforced backfill shall be free of debris and meet the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing
2-inch (50 mm)	100
3/4-inch (19 mm)	100-75
No. 40	0-60
No. 200	0-35

Plasticity Index (PI) <15 and Liquid Limit <40 per ASTM D-4318.

B. The maximum aggregate size shall be limited to 3/4 inch (19 mm) unless field tests have been performed to evaluate potential strength reductions to the geogrid design due to damage during construction.

C. Material can be site-excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.

D. Contractor shall submit reinforced fill sample and laboratory test results to the Architect/Engineer for approval prior to the use of any proposed reinforced fill material.

2.07 GEOGRID SOIL REINFORCEMENT

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 g/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.

B. Ta, Long Term Allowable Tensile Design Load, of the geogrid material shall be determined as follows:

Ta = Tult / (RFcr*RFd*RFid*FS)
Ta shall be evaluated based on a 75-year design life.

1. Tult, Short Term Ultimate Tensile Strength
Tult is based on the minimum average roll values (MARV)

2. RFcr, Reduction Factor for Long Term Tension Creep
RFcr shall be determined from 10,000-hour creep testing performed in accordance with ASTM D5262. Reduction value = 1.60 minimum.

3. RFd, Reduction Factor for Durability
RFd shall be determined from polymer specific durability testing covering the range of expected soil environments. RFd = 1.10 minimum.

4. RFid, Reduction Factor for Installation Damage
RFid shall be determined from product specific construction damage testing performed in accordance with GRI-GG4. Test results shall be provided for each product to be used with project specific or more severe soil type. RFid = 1.05 minimum.

5. FS, Overall Design Factor of Safety
FS shall be 1.5 unless otherwise noted for the maximum allowable working stress calculation.

C. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the “Hinge Height” divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

D. Soil Interaction Coefficient, Ci
Ci values shall be determined per GRI:GG5 at a maximum 0.75-inch (19 mm) displacement.

E. Manufacturing Quality Control
The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.
The QC testing shall include:
Tensile Strength Testing
Melt Flow Index (HDPE)
Molecular Weight (Polyester)

2.08 DRAINAGE PIPE

A. If required, the drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proof roll foundation area as directed to determine if remedial work is required.

B. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner.

3.02 BASE LEVELING PAD

A. Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6 inches (150 mm) and extend laterally a minimum of 6" (150 mm) in front and behind the modular wall unit.

B. Soil leveling pad materials shall be compacted to a minimum of 95 % Standard Proctor density per ASTM D-698

C. Leveling pad shall be prepared to insure full contact to the base surface of the concrete units.

3.03 MODULAR UNIT INSTALLATION

A. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated. If vertical unit alignment is chosen, units shall be uniformly tilted back towards the backfill slightly to create and maintain positive wall batter.

B. Place the front (any ”weathered” finish side) of units side-by-side. Do not leave gaps between adjacent units along the exposed face(s). Layout of corners and curves shall be in accordance with manufacturer's recommendations.

C. Install shear/connecting pins per manufacturer's recommendations.

D. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.

E. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

3.04 STRUCTURAL GEOGRID INSTALLATION

A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.

B. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.

C. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.

D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

3.05 REINFORCED BACKFILL PLACEMENT

A. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.

B. Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches (150 mm) where hand compaction is used, or 8 - 10 inches (200 to 250 mm) where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.

C. Reinforced backfill shall be compacted to 95% of the maximum density as determined by ASTM D698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be dry of optimum, + 0%, - 3%.

D. Only lightweight hand-operated equipment shall be allowed within 3 feet (1m) from the tail of the modular concrete unit.

E. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches (150 mm) is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

F. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH (15 KPH). Sudden braking and sharp turning shall be avoided.

G. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3.06 CAP INSTALLATION

A. Cap units shall be glued to underlying units with an all-weather adhesive recommended by the manufacturer (Keystone Kapseal or equivalent).

3.07 AS-BUILT CONSTRUCTION TOLERANCES

A. Vertical Alignment: ± 1.5" (40 mm) over any 10' (3 m) distance.

B. Wall Batter: within 2 degrees of design batter.

C. Horizontal alignment: ± 1.5" (40 mm) over any 10' (3 mm) distance.
Corners, bends & curves: ± 1 ft (300 mm) to theoretical location.

D. Maximum horizontal gap between erected units shall be 1/2 inch (13 mm).

3.08 FIELD QUALITY CONTROL

A. Quality Assurance - The Owner shall/may engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction. This does not relieve the Contractor from securing the necessary construction quality control testing.

B. Quality assurance should include foundation soil inspection. Verification of geotechnical design parameters, and verification that the contractor's quality control testing is adequate as a minimum. Quality assurance shall also include observation of construction for general compliance with design

drawings and project specifications. (*Quality assurance is usually best performed by the site geotechnical engineer.)*

C. Quality Control – The Contractor shall engage inspection and testing services to perform the minimum quality control testing described in the retaining wall design plans and specifications. Only qualified and experienced technicians and engineers shall perform testing and inspection services.

D. Quality control testing shall include soil and backfill testing to verify soil types and compaction and verification that the retaining wall is being constructed in accordance with the design plans and project specifications.

END OF SECTION 32 32 23

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. The requirements of the "General Conditions of the Contract" and of Division 1, "General Requirements", shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.02 SCOPE OF WORK

A. Provide all labor, materials, transportation, and services necessary to furnish and install Irrigation Systems as shown on the drawings and described herein.

B. Related work in other sections:
1. Turf and Grasses

B. The term of "LICENSED IRRIGATOR" shall refer to Teague Nall and Perkins, Inc., 5237 N. Riverside, Suite 100, Fort Worth, Texas 76137

1.03 QUALITY ASSURANCE & REQUIREMENTS

A. Permits and Fees: The Contractor shall obtain and pay for any and all permits and all observations as required.

B. Manufacturer's Directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications

C. Ordinances and Regulations: All local, municipal, and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and make a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations or requirements of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. Explanation of Drawings:
1. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
2. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.
3. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Licensed Irrigator immediately. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.04 SUBMITTALS

A. Material List:
1. The Contractor shall furnish the articles, equipment, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Licensed Irrigator.
2. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number, and description of all materials and equipment to be used.
3. Equipment or materials installed or furnished without prior approval of the Licensed Irrigator may be subject to rejection, and the Contractor required to remove such materials from the site at his own expense.
4. Approval of any item, alternate, or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.

5. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

B. Record and As-Built Drawings:
1. The Contractor shall provide and keep an up-to-date and complete "as-built" record set of blue line ozalid prints which shall be corrected daily and show every change from the original drawings and specifications, the exact "as-built" locations, sizes, and kinds of equipment. Prints for these purposes may be obtained from the Licensed Irrigator at cost. This set of drawings shall be kept on the site and shall be used only as a record set.
2. These drawings shall also serve as work progress sheets and shall be the basis for measurement and payment for work completed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Licensed Irrigator. Should the record blue line as-built progress sheets not be available for review or not up-to-date at the time of any inspection (refer to Section 3.09 - Observation Schedule), it will be assumed no work has been completed and the Contractor will be assessed the cost of that site visit at the current billing rate of the Licensed Irrigator. No other observations shall take place prior to payment of that assessment.
3. The Contractor shall make neat and legible notations on the as-built progress sheets daily as the work proceeds, showing the work as actually installed. For example, should a piece of equipment be installed in a location that does not match the plan, the Contractor must indicate that equipment has been relocated in a graphic manner so as to match the original symbols as indicated in the irrigation legend. The relocated equipment and dimensions will then be transferred to the original as-built plan at the proper time.
4. Hand drawn: In lieu of electronically drawn, before the date of the final inspection, the Contractor shall transfer all information from the "as-built" prints to a sepia Mylar, or similar Mylar material, procured from the Licensed Irrigator. All work shall be in waterproof India ink and applied to the Mylar be a technical pen made expressly for use on Mylar material. Such pen shall be similar to those manufactured by Rapidograph, Kueffell & Esser, or Faber Castell. The dimensions shall be made so as to be easily readable, even on the final controller chart (see Section C). The original Mylar "as-built" plan shall be submitted to the Licensed Irrigator for approval prior to the making of the controller chart.
5. Electronically drawn: In lieu of hand drawn, before the date of the final inspection, the Contractor shall transfer all information from the "as-built" prints to an AutoCAD electronic file procured from the Licensed Irrigator. All work shall be documented on a unique and separate layer. The electronically drawn "as-built" plan shall be submitted to the Licensed Irrigator for approval prior to the making of the controller chart.
6. The Contractor shall dimension from two (2) permanent points of reference - building corners, sidewalks, road intersections, etc. - the location of the following items:
   a. Connection to existing water lines
   b. Connection to existing electrical power
   c. Gate valves
   d. Routing of irrigation pressure lines (dimension maximum 100' along routing).
   e. Irrigation control valves.
   f. Routing of control wiring.
   g. Quick coupling valves.
   h. Road and sidewalk borings
   I. Other related equipment as directed by the Licensed Irrigator
7. On or before the date of the final inspection, the Contractor shall deliver the corrected and completed sepias to the Licensed Irrigator. Delivery of the sepias will not relieve the Contractor of the responsibility of furnishing required information that maybe omitted from the prints.

C. Controller Charts:
1. As-built drawings shall be approved by the Licensed Irrigator before controller charts are prepared.
2. Provide on (1) controller chart for each controller supplied.
3. The chart shall show the area controlled by the automatic controller and any area under a manual irrigation. The chart shall be the maximum size which the controller door will allow.
4. The chart is to be a reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing(s) is reduced, it shall be enlarged to a size that will be readable when reduced.
5. The chart shall be a black line print. A different color shall be used to indicate the area of coverage for each station.
6. When completed and approved, the chart will be hermetically sealed between two (2) pieces of plastic, each piece being a minimum 10 mils thickness.
7. These charts shall be completed and approved prior to final inspection of the irrigation system.

D. Operation and Maintenance Manuals:
1. Prepare and deliver to the Licensed Irrigator within ten (10) calendar days prior to completion of construction, two (2) hard cover binders with three (3) rings containing the followings information:
   a. Index sheet stating Contractor's address and telephone number, list of equipment with name and

addresses of local manufacturer's representative
b. Catalog and parts sheets on every material and equipment installed under this contract.
c. Guarantee statement.
d. Complete operating and maintenance instructions on all major equipment, i.e. the automatic controller(s).

2. In addition to the above mentioned maintenance manuals, provide the Licensed Irrigator with instructions for major equipment and show evidence, in writing, to the Licensed Irrigator at the conclusion of the project that this service has been rendered.

E. Equipment to be Furnished:
1. Supply as a part of this Contract the following tools:
a. Two (2) sets of special tools required for removing, disassembling and adjusting each type of irrigation head and valve supplied on this project.
b. Two (2) four foot valve keys for operation of the ball and remote control valves.
c. Two (2) keys for each automatic controller.
d. One (1) quick coupler key and matching hose swivel ell for every five (5), or fraction thereof, of each type of quick coupling valve installed.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been damaged will be discarded and, if installed, shall be replaced with new piping.

1.06 SUBSTITUTIONS

A. If the Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the drawings and specifications, he may do so by providing the following information to the Licensed Irrigator for approval:
1. Provide a statement indicating the reason for making the substitution. Use a separate sheet of paper for each item to be substituted.
2. Provide descriptive catalog literature, performance charts, and flow charts for each item to be substituted.
3. Provide the amount of cost savings if the substituted item is approved.

B. The Licensed Irrigator shall have the sole responsibility in accepting or rejecting any substituted item as an approved equal to those equipment and materials listed on the irrigation drawings and specifications

1.07 GUARANTEE

A. The guarantee for the planting irrigation system shall be made in accordance with the attached form. The general conditions and supplementary conditions of these specifications shall be filed with the Owner and the Licensed Irrigator prior to acceptance of the irrigation system.

B. A copy of the guarantee form shall be included in the operations and maintenance manual.

C. The guarantee form shall be re-typed onto the Contractor's letterhead and contain the following information:

GUARANTEE FOR PLANTING IRRIGATION SYSTEM

We hereby guarantee that the planting irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacement within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT: _____

LOCATION: _____

_____

SIGNED: _____

COMPANY: _____

ADDRESS: _____

_____

_____

PHONE: (_____) _____ -- _____

DATE OF ACCEPTANCE: _____ / _____ / _____

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Use only new materials of brands and types noted on drawings, specified herein, or approved equals.

B. PVC pressure main line pipe and fittings:
1. Pressure main line piping for sizes 3" and smaller shall be PVC Class 200 with solvent welded joints.
2. Pipe shall be make from NSF approved Type I, Grade II PVC compound conforming to ASTM resin specification D1784. All pipes must meet requirements as set forth in Federal Specification PS-22-70.
3. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM test procedure D2466.
4. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.
5. All PVC pipe must bear the following markings:
   a. Manufacturer's name
   b. Nominal pipe size
   c. Schedule or class
   d. Pressure rating in P.S.I.
   e. NSF (National Sanitation Foundation) approval
   f. Date of extrusion
6. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

C. PVC Non-Pressure Lateral Line Piping:
1. Non-pressure buried lateral line piping shall be PVC class 200 with solvent-weld joints.
2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound to ASTM resin specification D1784. All pipes must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.
3. Except as noted in paragraphs 1 and 2 of Section 2.01B, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in Section 2.01B of these specifications.

D. Copper Piping and Fittings:
1. Copper piping shall be type "K" hard-drawn with "sweat" type fittings.
2. Pipe and fittings shall be assembled with 50/50 soft solder and non-erosive flux. Solder shall take up capillary action and joints shall be made tight without build-up head.
3. Pipe ends shall be squared, reamed to remove burrs, and cleaned bright with fine sandpaper and steel wool.

E. Ball Valves:
1. Ball valves shall be similar to those manufactured by Lasco, or approved equal, with threaded ends and equipped with a hand lever.
2. All ball valves shall be installed per installation detail and the manufacturer's recommendations.

F. Gate Valves:
1. Gate valves shall be manufactured out of bronze, pressure rated to 125 psi WSP, 200 psi WOG nonshock. Valves shall be resistant to rust and moderate atmospheric corrosion. Valves shall be the same size as the mainline. Valve shall have threaded IPS bonnet and non-rising stem, with female threaded inlets and equipped with a “Sure Grip” type handle. Similar to those manufactured by Watts Regulator Company Series GV, or approved equal.
2. All gate valves shall be installed per the manufacturer's recommendations.

G. Quick Coupling Valves: Quick coupling valves shall have a brass two-piece body designed for working pressure of 150 p.s.i. operable with quick coupler. Key size and type shall be as shown on the plans.

H. Backflow Prevention Units:
1. Backflow prevention units shall be of size and type indicated on the drawings. Install backflow prevention units in accordance with irrigation construction details.
2. Wye strainers at backflow prevention units shall have a bronzed, screwed body with 60 mesh monel screen and shall be similar to Bailey #100B, or approved equal.

I. Automatic Drain Valves:

1. Automatic drain valves shall be plunger type, duty virgin PVC construction, with small thread inlet.
2. Drain valve shall be installed at an angle of 30 to 45 degrees horizontal, in a direction to facilitate pipe drainage.
3. Provide sump pit for drainage.

J. Control Wiring:
1. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire, AWG-U.F. 600 volt.
2. Pilot wires shall be a different color wire for each automatic controller.
3. Common wires shall be white with a different color stripe for each automatic controller.
4. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall the wire size be less than #14 gauge.
5. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
6. Where more than one (1) wire in placed in a trench, the wiring shall be taped together at intervals of ten (10) feet.
7. An expansion curl shall be provided within three (3) feet of each wire connection. Expansion curl shall be of sufficient length at each splice connection at each electric remote control valve, so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in the trench without stress or stretching of control wire conductors.
8. All splices shall be made with Scotch-Lok #3576 Connector Sealing Packs, Rain Bird Snap-Tite wire connector, or approved equal. Use one (1) splice per connector sealing pack.
9. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Licensed Irrigator. All approved field splices shall be placed in a Control Valve Box and labeled appropriately.

K. Automatic Controllers:
1. Automatic controllers shall be of size and type shown on the plans.
2. Final location of the automatic controller shall be furnished by others.
3. Unless otherwise noted on the plans, the 120 volt electrical power to each automatic controller location shall be furnished by others. The final electrical hook-up shall be the responsibility of others.

L. Electrical Control Valves:
1. All electric control valves shall be the same manufacture as the automatic controller.
2. All electric control valves shall have a manual flow adjustment.
3. Furnish and install one (1) control valve box for each electric control valve.

M. Control Valve Boxes:
1. Use 10" round box for all field splices, Oldcastle Enclosure Solutions Model 910 with green cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.
2. Use 14" X 19" standard rectangular box for all gate valves and quick coupler valves, Oldcastle Enclosure Solutions Model 1419 with green, “Drop-N-Lock” lid cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.
3. Use 13" X 24" jumbo rectangular box for all electric control valves, Oldcastle Enclosure Solutions Model 1324 with green, “Drop-N-Lock” lid cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.

N. Irrigation Heads:
1. All irrigation heads shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the drawings, or specified in these special provisions.
2. Spray heads shall have a screw adjustment.
3. Riser units shall be fabricated in accordance with the details shown on the plans.
4. Riser nipples for all irrigation heads shall be the same size as the riser opening in the irrigation body.
5. All irrigation heads of the same type shall be of the same manufacture.

PART 3 - EXECUTION

3.01 INSPECTION

A. Site Conditions:
1. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive the Licensed Irrigator's approval prior to proceeding with work under this section.
2. Exercise extreme care in excavating and working near existing utilities. The Contractor shall be

responsible for damages to utilities which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.

3. Coordinate installation of planting irrigation materials including pipe, so there shall be NO interference with utilities or other construction or difficulty in planting trees, shrubs, and ground covers.
4. The Contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the planting irrigation system.

3.02 PREPARATION

A. Physical Layout:
   1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of irrigation heads.
   2. All layout shall be approved by the Licensed Irrigator prior to installation.

B. Water Supply:
   1. Planting irrigation system shall be connected to water supply points of connection as indicated on the drawings.
   2. Connections shall be made at approximate locations as shown on the drawings. The Contractor is responsible for minor changes caused by actual site conditions.
   3. The point of connection shall be as shown on the drawings and shall be furnished by the Contractor, unless otherwise specified.

C. Electrical Supply:
   1. Electrical connections for the automatic controller shall be made to electrical points of connection as indicated on the drawings.
   2. Connections shall be made at approximate locations, as shown on the drawings. The Contractor is responsible for minor changes caused by actual site conditions.

3.03 INSTALLATION

A. Trenching:
   1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on the drawings, and as noted.
   2. Provide for a minimum of eighteen (18) inches cover for all pressure supply lines.
   3. Provide for a minimum cover of twelve (12) inches for all non-pressure lines.
   4. Provide for a minimum cover of eighteen (18) inches for all control wiring.

B. Backfilling:
   1. The trenches shall be backfilled a maximum of 50% with all joints exposed until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from clods of earth or stones larger than one-half (1/2) inch. Backfill shall be mechanically compacted landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps, or other surface irregularities.
   2. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than one-half (1/2) inch in size will be permitted in the initial backfill.
   3. Flooding of trenches will be permitted only with approval of the Licensed Irrigator.
   4. If settlement occurs and subsequent adjustments in pipe, valves, irrigation heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.

C. Trenching and Backfill Under Paving:
   1. Trenches located under areas where paving, asphaltic concrete or concrete, will be installed shall be backfilled with sand (a layer of six [6] inches below the pipe and three [3] inches above the pipe) and compacted in layers to 95% standard proctor, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm, unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
   2. Generally piping under existing walks is done by jacking, boring, or hydraulic driving, but where any cutting or breaking of sidewalks or concrete is necessary, it shall be done and replaced by the Contractor as part of the contract cost, to the satisfaction of the Construction Manager. Permission to cut or break sidewalks or concrete shall be obtained from the Construction Manager. NO hydraulic driving will be permitted under concrete paving.

3. Provide for a minimum cover of eighteen (18) inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies:
1. Routing of planting irrigation lines as indicated on the drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform to the details per plans.
2. Install NO multiple assemblies in plastic lines. Provide each assembly with its own outlet.
3. Install all assemblies specified herein in accordance with the respective detail. In the absence of detail drawings or specifications pertaining to specific items required to complete the work, perform such work in accordance with the best standard practice, with the approval of the Licensed Irrigator.
4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust, and moisture before the installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape, or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

E. Line Clearance: All lines shall have a minimum clearance of six (6) inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Automatic Controller: Install the automatic controller(s) in accordance with the manufacturer's instructions. Remote control valves shall be connected to the controller in the numerical sequence as shown on the drawings.

G. High Voltage Wiring for Automatic Controller:
1. 120 volt electrical service for the automatic controller shall be the responsibility of the Contractor. The Contractor shall be responsible for permitting and getting the electrical utility service company to install the appropriate electrical service and meter base necessary to operate each automatic controller. The final location of the electrical meter base shall be approved by the Licensed Irrigator.
2. 120 volt electrical service connection to the automatic controller shall be provided by the Contractor.
3. All electrical work shall conform to local codes, ordinances, and union authorities having jurisdiction.

H. Remote Control Valves: Install remote control valves where shown on the drawings and per the detail. When valves are grouped together, allow at least thirty-six (36) inches between valves. Install each remote control valve in a separate valve box. Each valve number (per the drawings) shall be stenciled on the valve box lid with exterior paint. Paint color shall be flat black. Stencil number size shall be 3" in height.

I. Gate Valves: Install gate valves where shown on the drawings. When valves are grouped together, allow at least thirty-six (36) inches between valves. Install each gate valve in a separate valve box. Each gate valve shall have stenciled on the valve box lid, "GV" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

J. Ball Valves: Install ball valves where shown on the drawings and per the detail. When valves are grouped together, allow at least thirty-six (36) inches between valves. Install each ball valve in a separate valve box. Each ball valve shall have stenciled on the valve box lid, "BV" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

K. Quick Coupler Valves: Install where shown on the drawings and per the detail. Install each quick coupler valve in a separate valve box. Each quick coupler valve shall have stenciled on the valve box lid, "QC" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

L. Flushing of the System:
1. After all new irrigation pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of the irrigation heads, the control valves shall be opened and full head of water used to flush out the system.

2. Irrigation heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Licensed Irrigator.

M. Irrigation Heads:
1. Install the irrigation heads as designated on the drawings. Irrigation heads to be installed in this

work shall be equivalent in all respects to those itemized.

2. Spacing of heads shall not exceed the maximum indicated on the drawings. In NO case shall the spacing exceed the maximum recommended by the manufacturer.

N. Field Splices: Install field splices of control valve wiring in a valve box (see Section 2.01 L.1). Each field splice valve box lid shall have stenciled "Field Splice" on it with exterior paint. Paint color shall be flat black. Stencil letter shall be 3" in height.

3.04 TEMPORARY REPAIRS

The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

3.05 FIELD QUALITY CONTROL

A. Adjustment of the System:
   1. The Contractor shall flush and adjust all irrigation heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.
   2. If it is determined by the Licensed Irrigator that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
   3. Lowering raised irrigation heads by the Contractor shall be accomplished within ten (10) calendar days after notification by the Licensed Irrigator.
   4. All irrigation heads shall be set perpendicular to finished grades unless otherwise designated on the drawings.

B. Testing of Irrigation System:
   1. The Contractor shall request the presence of the Licensed Irrigator, in writing, at least 24 hours in advance of the testing.
   2. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight. Note that the testing of pressure main lines shall occur prior to installation of the electric remote control valves.
   3. All piping under paved areas shall be tested under hydrostatic pressured of 150 pounds per square inch, and proved watertight, prior to paving.
   4. Sustain pressure in lines for not less than four (4) hours. If leaks develop, replace joints and repeat the test until the entire system is proven watertight.
   5. All hydrostatic tests shall be made only in the presence of the Licensed Irrigator. NO pipe shall be completely backfilled until it has been inspected, tested, and approved in writing.
   6. Furnish necessary force pump and all other test equipment.
   7. When the planting irrigation system is completed, perform a coverage test in the presence of the Licensed Irrigator, to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed, as indicated on the drawings, when it is obviously inadequate, without bringing this to the attention of the Licensed Irrigator. This test shall be accomplished before any ground cover is planted.
   8. Upon completion of each phase of work, the entire system shall be tested and adjusted to meet site requirements.

3.06 MAINTENANCE

A. The entire planting irrigation system shall be under full automatic operation for a period of seven (7) calendar days prior to any planting.
B. The Licensed Irrigator reserves the right to waive or shorten the operation period.

3.07 CLEAN-UP

Clean-up shall be made daily as each portion of the work progresses. Refuse and excess dirt shall be removed, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to the original condition.

3.08 FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. The Contractor shall operate each system in its entirety for the Licensed Irrigator, at the time of the final observation. Any items deemed not acceptable by the Licensed Irrigator shall be re-worked to the complete satisfaction of the Licensed Irrigator.

B. The Contractor shall show evidence to the Licensed Irrigator that the Owner has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

3.09 OBSERVATION SCHEDULE

A. The Contractor shall be responsible for notifying the Licensed Irrigator, in advance, for the following observation meetings, according to the time indicated:
   1. Pre-Job Conference - 7 days.
   2. Pressure supply line installation & testing - 48 hours
   3. Automatic controller installation - 48 hours
   4. Control wire installation - 48 hours
   5. Lateral line and irrigation installation - 48 hours
   6. Coverage test - 48 hours
   7. Final inspection - 7 days

B. When observations have been conducted by other than the Licensed Irrigator, show evidence, in writing, of when and by whom these observations were made.

C. NO site observations will commence without as-built drawings. In the event the Contractor calls for a site visit without as-built drawings, without completing previously noted corrections, or without preparing the system for the said visit, he shall be responsible for reimbursing the Licensed Irrigator at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further site visits will be scheduled until this charge has been paid and received.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART I - GENERAL

1.01 SUMMARY

A. Work included:

1. Lawn work shall include seeding, sodding and maintenance operations through the one-year warranty period as indicated on plans and specified herein.

2. Provide all labor, materials, and equipment necessary to perform the seeding, and sodding work, complete, as indicated on the Drawings and as specified.

1.02 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM): D 1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457mm) Drop.

1.03 SUBMITTALS

A. Delivery Receipts and Invoices: Submit original delivery receipts and invoices for materials used.

B. Samples and Product Information: Representative samples or product information of the following materials shall be provided to the Landscape Architect from the supply source that is to be used for turf grass areas and native grass seeded areas:

1. Seed type and purity analysis.

2. Sod type, growing conditions, and certification.

3. Fertilizer specifications and guaranteed analysis.

4. Mulch material components, chemical analysis, and manufacturer.

5. Tackifier material components and manufacturer.

6. Hydromulch manufacturer and type of mulch to be used.

7. Sod certification documentation to include the following:

a. Kind – Bermuda, etc…

b. Variety – Common Bermuda, etc…

c. Lot Number – If applicable

d. Sod – Record of square feet shipped.

e. Bill of Lading / Invoice # - This is an invoice number that can be referenced to the purchaser of the shipment.

f. Field # - the field number references the harvested grass to the production field. The field number must be the same as on the certification application and field inspection report.

g. Harvest Date – Record the date the grass was harvested.

h. Grower Name and Address- Record the production company name and address. Use of a stamp is acceptable if it shows on all copies.

B. Construction Schedule: At least two weeks prior to start of work, submit seeding or sodding schedule.

C. Maintenance: Submit three copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of the lawns for an entire year. Submit prior to Notice of Substantial Completion.

1.04 QUALITY ASSURANCE

A. Contractor's Qualifications

1. The work of this section shall be performed by a Contractor specializing in seeding, sodding, or landscape installations.
2. The Contractor shall have successfully completed at least 5 installations of this type, size, and complexity in the last four years.

B. Lawn materials shall comply with all government regulations prevailing at the supply source and the job site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod

1. Do not dig sod at the nursery or other approved source until ready to transport sod to the project site or approved storage location.
2. Before stripping, sod shall be mowed at a uniform height of 2”.
3. Sod to be cut and delivered in rolled widths.
4. Cut sod to specified thickness and to standard width and length desired

B. Transporting Sod

1. Sod transported to the Project in open vehicles shall be covered with tarps or other suitable covers securely fastened to the body of the vehicle to prevent injury to the sod. Closed vehicles shall be adequately ventilated to prevent overheating of the sod. Evidence of inadequate protection against drying out in transit shall be cause for rejection.
2. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or in temporary storage.
3. Upon arrival at the temporary storage location or the site of the work, sod shall be inspected for proper shipping procedures. Should the roots be dried out, the Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall remove it at once from the area of the work and replace it.
4. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of sod. A legible copy of the invoice, showing species and variety of sod included for each shipment shall be submitted to the Landscape Architect.
5. Certificate of Inspection when required must accompany each sod shipment.

C. Handling and Storage of Sod

1. No sod shall remain in temporary storage over 30 hours, and less time may be required during extremely high temperatures.
2. Sod shall be kept moist and shall be stored in a compact group to prevent drying out or freezing.
3. Contractor shall take extreme care in the handling of sod material to avoid breaking or tearing strips. Sod that has been damaged by poor handling may be rejected by the Landscape Architect.

1.06 JOB CONDITIONS

A. Do not install sod on saturated or frozen soil.

B. Sod installation shall be subject to suitability of the weather and other conditions affecting sod growth.

C. Planting season may be extended only with the written permission of the Landscape Architect.

1.07 GUARANTEE

A. Warrant all lawns for a period of one year from date of Notice of Substantial Completion, to be at least the quality and conditions as at Final Acceptance. Promptly reseed or resod unacceptable areas during the warranty period as directed by the Landscape Architect.

B. Lawn shall be uniform in color, grass type, leaf texture, leaf and root density, and free from weeds, diseases, and other visible imperfections at acceptance.

C. Guarantee does not cover damage as a result of deicing compounds, fertilizers, pesticides, or other applications not supervised by the Contractor or as a result of acts of God or vandalism.

1.08 ACCEPTANCE

A. The Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

B. Acceptance will be based on establishment of a uniform stand of turf grass, defined as coverage of specified grass at a density of 95 percent coverage, with no bare spots greater than one square foot, free of weeds, undesirable grass species, disease, and insects. For grass varieties selected, allow a minimum of 90 days for establishment and maintenance of an acceptable strand of grass.

C. In areas that are grassed and not irrigated. An acceptable strand of grass shall be established and the Landscape Architect will inspect the work for Substantial Completion upon written request of the Contractor.

D. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Landscape Architect, the Landscape Architect will recommend to the Owner that the work of this Section be accepted.

PART 2 - MATERIALS

2.01 SOLID SOD

A. Sod shall be TIF 419 Bermuda grass and Buffalo grass as specified on plans, nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully and otherwise maintained from planting to harvest.

B. Solid Sod shall be of species indicated in rolled widths or provided a block sod around areas near the building, facilities, retaining walls or playground.

C. Thickness of Cut: Sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2” on width and plus or minus 5% on length. Broken strips and torn or uneven ends will not be accepted.

D. Strength of Sod Strips: Sod strips shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.

E. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively wet or dry) may adversely affect its survival.

F. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 30 hour period unless a suitable preservation method is approved by the Landscape Architect prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Landscape Architect prior to its installation.

G. Thatch: Sod shall be relatively free of thatch. A maximum on 1/2” (uncompressed) thatch will be permitted.

H. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects.

1. Weeds: Sod shall be free of objectionable grassy and broadleaf weeds.

2.02 HYDROMULCH

A. All materials shall be of standard, approved, and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original, unopened container bearing the manufacturer's guaranteed analysis. The Contractor shall supply the Landscape Architect with a sample of all supplied materials accompanied by analytical compliance or bearing the manufacturer's guaranteed analysis.

B. Hydromulch Fertilizer:
1. Ammonium Phosphate which shall consist of the following percentages by weight, shall be mixed by a commercial fertilizer supplier, and shall be water soluble:
16% Nitrogen
8% Phosphoric Acid
8% Potash

C. Plant Material:

1. Plants shall be in accordance with the Texas State Department of Agriculture's Regulation for nursery inspections, rules, and ratings. Any plants rendered unsuitable for planting because of an inspection will be considered as samples and will be provided at the expense of the Contractor.

2. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and conditions specified herein. Under no conditions will there be any substitutions of plants or sizes listed on the accompanying plans, except with the expressed, written consent of the Landscape Architect.

3. Plant material shall be true to botanical and common name and variety as specified in the "American Standard of Nursery Stock Editions" and "Standardized Plant Names".

4. Substitute plant material will not be permitted unless specifically approved, in writing, by the Landscape Architect.

5. Seed:

a. All seed used shall be labeled and shall be furnished in sealed standard containers with signed copies of a statement from the vendor certifying that each container of seed delivered is fully labeled in accordance with the Texas State Agricultural Code and is equal to or better than the requirements of these specifications.

b. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

c. Seed shall be Native American Seed ‘Blackland Prairie Mix’

D. Hydromulch Fiber Mulch:

1. "Hydromulch" as manufactured by Conwed Fibers, 1985 Tate Blvd., Suite 350, Hickory, NC 28601, (704) 327-6670, or approved equal.

2. The hydromulch shall be composed of virgin wood cellulose fibers and contain no germination or growth-inhibiting factors. It shall have a consistent texture which disperses evenly and remain suspended in agitated water. It shall have a temporary green dye and the following property analysis:
Moisture Content - 9.0% + 3% O.D. Basis
Organic Matter - 99.2% + 0.8 %
Ash Content - 0.8% + 0.2 %
pH - 4.8% + 0.5%
Water Holding Capacity (grams of H2O per 100 grams of fiber) - 1150 minimum

E. Hydromulching Additive (Binder):
1. Ecology "Control-M-Binder" organic seeding additive. Use half of the manufacturers recommended rate of tackifier or refer to recommendations from Native American Seed.

F. Water: Source furnished by the Contractor, cost and transport of water, as required, by the Contractor.

G. Soil Saver Netting: Jute mesh netting as manufactured by Ludlow, or approved equal.

2.03 FERTILIZER

A. Fertilizer shall be a complete fertilizer, part of the elements of which is derived from organic sources. The percentages by weight shall be a minimum of 15-15-15, also containing 10-15% sulphate & traces of iron & zinc as approved by owner.

2.04 TOPSOIL

A. All existing topsoil stripped for this work and suitable for reuse shall be stored on site as directed by the Landscape Architect. Dispose of all excess topsoil on the site as directed by the Landscape Architect.

B. Utilize on-site topsoil to provide a minimum 4” layer of approved soil for sod and native seed installation as specified and indicated on the Drawings.

C. If on-site topsoil is not available, imported topsoil shall be used as indicated on the drawings and shall be as follows:

1. Natural, fertile, friable agricultural soil, having characteristics of representative productive soils in the vicinity, and obtained from naturally well-drained areas.
2. Topsoil shall not be excessively acid or alkaline nor contain toxic substances.
3. Topsoil shall be without admixture of subsoil and shall be reasonably free from clay lumps, stones, stumps, roots, live plants, or similar substances one inch or more in diameter, debris, or other objects which might be a hindrance to planting operations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Weed Control

1. Spray one application of a non-selective, systemic contract herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.
2. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4" below the surface of the soil over the entire area to be planted.
3. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.
4. All areas to be seeded should start with a weed-free, smooth raked seedbed. Reduce invasive perennial weeds such as Bermuda and Johnson grass prior to planting native grass.

B. Grade Preparation

1. Immediately before seeding or sodding, scarify, loosen, float and drag the upper 1-2 inches of topsoil to bring it to the proper condition. Remove foreign matter larger than 1/2” in diameter.
2. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts or depressions that would cause water to stand or pond immediately after rainfall or operation of the lawn irrigation system, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.
3. If the prepared grade is eroded or compacted by rainfall prior to fertilizing, rework the surface to specified condition.
4. Sod to be placed after final grade is approved in a timely manner not to exceed a 48 hour period from time of approval to laying of sod.
5. Firm the area to be seeded by rolling or packing the surface.

C. Fertilizing

1. Uniformly distribute fertilizer by mechanical means at the rate of 12 pounds per 1,000 square feet.
2. If applying a fertilizer with a percentage by weight not as specified, apply at the rate of 2 pounds actual nitrogen per 1,000 square feet.
3. Work fertilizer into the soil after fine grading & not more than 2 days prior to grass planting. Cultivating equipment shall be set so the fertilizer will not penetrate into the soil more than 1 inch. Do not apply fertilizer when there is a possibility of rain before lawn areas can be sodded.

3.02 SPREADING OF TOPSOIL

A. Topsoil and subgrade shall be damp when topsoil is spread.

B. Areas to be seeded or sodded shall be topsoiled to a minimum depth of 4 in., compacted measure. Provide additional topsoil depths as required to construct the grades indicated on the Drawings. Topsoil shall be compacted to 85% completion, determined in accordance with ASTM: D 1557. Onsite topsoil is to be used unless otherwise stated by landscape architect prior to construction.

3.03 SODDING

A. Weather Conditions

1. Schedule work for periods of favorable weather.
2. Sod placement on days that, in the judgment of the Landscape Architect, are too hot, sunny, dry, or windy for optimal installation may be prohibited.

B. Placement Pattern

1. The first row shall be laid in a straight line with subsequent rows parallel to the first row and tightly abutting each other.
2. **Plastic netting shall be removed and properly disposed of upon installation.**
3. Lateral joints shall be staggered. Care shall be exercised to insure that the sod is neither stretched nor overlapped. Joints must be butted tightly to prevent voids that could permit air to dry out roots.
3. Immediately after placing, sod shall be pressed firmly into contact with sod bed by tamping or rolling to eliminate air pockets.
4. When on slopes steeper than 4 to 1, sod shall be secured by galvanized pins, wood pegs or other methods approved by the Landscape Architect.
5. Immediately after sodding operations have been completed, entire surface shall be compacted with a roller or other approved equipment. The completed area after sodding shall be uniformly even, firm, and true to finished grade lines.
6. In large areas of sod rolled sod shall be used. Runs shall be maximized to minimized small pieces. Lay sod avoid small and skinny pieces
7. A bobcat and/or tractor with a “big roll” attachment shall be used to lay the rolls of sod.

C. Watering

1. Provide an adequate supply of water at the site prior to and during transplanting of the sod.
2. Water the newly seeded areas lightly and frequently to prevent the top of the soil from drying out. When the grass is about an inch tall, decrease the frequency and increase the depth of watering.

3.04 SEEDING/HYDROMULCHING/COMPOSTING

A. Sow seed during the periods indicated below unless otherwise approved by the Landscape Architect. Do not sow seed when weather conditions are unfavorable, such as during drought or high winds.

1. Seed only during the Spring or in the Fall. If planting between October and Feb then add a nurse crop of Cereal Rye grain at the rate of 100 lbs per ac in addition to the Blackland Prairie Mix.
2. If seeding cannot occur within the specified period, an alternative will be proposed by the Contractor.
3. Perform seeding using approved equipment such as cultipacker seeders, grass seed drill, or wildflower seeder.
4. Hydromulch Capping: Immediately following sprigging or seeding operations, all turf areas are to be capped with wood fiber mulch, using conventional “Hydro-Mulch equipment as manufactured by the Bowie Machine Works, or an approved equal. The hydromulch cap shall be applied at the rate of forty-six (46) pounds per one thousand (1,000) square feet (2,000 pounds per acre), using water at the rate of twenty-three (23) gallons per one thousand (1,000) square feet (1,000 gallons per acre).
5. Erosion Control Composting (ECC): Seed shall be injected into compost as it is coming out of the truck during application. Seed shall **not** be mixed in the tank prior to application. Fertilizer shall be applied prior to application of ECC. See compost specification for rates and depth of application.
6. Water thoroughly and immediately with a fine mist until soil is soaked to a depth of 3”. Maintain soil in a moist condition until seeds have sprouted and reached a height of 1”. Water thereafter at least once every 7 days unless natural rainfall has provided equivalent watering.

3.05 MAINTENANCE

A. Immediately after sodding or hydromulching the area shall be protected against traffic or other use by erecting barricades as needed, and by placing approved warning signs at appropriate intervals.

B. Mow during establishment only for the purpose of weed control and to promote quicker spreading. Mow to a 2” height.

C. Fill any depressions or settlement that occurs within **90** days following installation. Reseed or resod bare spots that occur during the maintenance period as directed by the Landscape Architect.

D. Keep lawns clean and protected from damage during the maintenance period. Debris that accumulates shall be removed from the site. Promptly repair damaged lawns except as provided in Paragraph 1.8, guarantee.

E. Irrigate as required to supplement natural rainfall so that all lawn areas receive sufficient water for normal plant growth. **Furnish all irrigation equipment needed for watering and be responsible for securing adequate supply of water if an automatic irrigation system does not exist, is not operating or is not designed in a particular area.**

F. A second fertilizer application shall be made 60 days after installation. The specified fertilizer shall be a ratio of 15-5-10 applied at 800 pounds per acre.

3.06 CLEANING, REMOVAL, AND REPAIR

A. Paved areas over which hauling operations have been conducted shall be kept clean. Promptly remove materials spilled on pavement.

B. Upon completion of lawn installation, remove from the site and legally dispose of the following:

1. Surplus subgrade material.
2. Stone and foreign matter.

C. Excess topsoil not required for lawns or planting shall be stockpiled on site for future use as directed by the Owner's representative.

D. Repair existing lawns damaged by operations under the contract. Repair shall include finish grading, seeding or sodding as required to match existing grade and lawn, and maintenance of repaired areas.

3.07 GUARANTEE

A. All plant material shall be guaranteed by the contractor for a period of one (1) year from the date of final acceptance.

B. At the end of the guarantee period the Landscape Architect and Contractor shall inspect plant material. Any plant material under this contract that is dead or of an unsatisfactory growth condition shall be removed and replaced in a timely fashion by the contractor, at no cost to the owner.

3.08 ACCEPTANCE OF WORK

A. The contractor and Landscape Architect shall conduct an on-site inspection of all work and materials to determine compliance of work with the construction documents.

B. The contractor shall within reasonable means provide the Landscape Architect with sufficient data to demonstrate compliance with the construction documents.

C. The contractor shall be notified in writing of any non-conforming items, which are to be corrected (punch-list).

D. The contractor and Landscape Architect shall conduct an on-site inspection to verify completeness of punch list items.

E. Acceptance of work by the Owner shall begin upon verifying completion of punch list items and receipt of all deliverable items to Owner including letter of guarantee; release of liens waiver, record drawings denoting deviations from contract drawings, product data and maintenance guide.

F. The contractor shall receive written notification of date of final acceptance and ending date of required guarantee periods from the Landscape Architect.

END OF SECTION

SECTION 32 93 00

TREES, SHRUBS, AND GROUNDCOVERS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

The requirements of the "General Conditions of the Contract" shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.02 SUMMARY

A. Work Includes:

1. Plant materials, installation, soil treatments, and maintenance operations through the one year warranty period of all trees, shrubs, ground covers, annuals, perennials and vines as indicated on drawings and specified herein.

1.03 SUBMITTALS

A. Samples and Product Information: Representative samples or product information of the following materials shall be provided to the Landscape Architect from the supply source being used:

1. Plant material: Samples or photos with growers name, location, and phone number may be requested in lieu of inspection at the nursery. Submit original receipts or invoices for all materials.
2. Mulch: One (1) pound sample and product information, chemical analysis and manufacturer.
3. Soil Amendment for Shrubs and Groundcover - One (1) pound sample, product information and original delivery tickets or receipts.
4. Soil Amendment for Trees - One (1) pound sample, product information and original delivery tickets or receipts.
5. Weed barrier product information and sample.
6. Fertilizer specifications and guaranteed analysis.
7. Decomposed granite product information and sample.

B. Test Reports: Submit to the Landscape Architect two copies each of certified test reports for:
1 Topsoil (Top 1 inch to 4 inches).
2. Subsoil (6 to 8 inches below Finish Grade).
3. Organic Matter: 1 pound sample and product information.

C. Certification
1. All plant material inspection certificates required by federal, state, or other governing authorities will accompany each shipment and be turned over to the Landscape Architect upon delivery.
2. Invoice: Original vendor's or growers invoice for each shipment of plants, soil amendments, and mulch shall show sizes, quantities, and root treatment of plants, i.e., containerized, balled and burlapped, or bare root.

D. Construction Schedule: Upon authorization to proceed with the work, submit three copies of Construction Schedule indicating dates for the items of work.

E. Maintenance instructions: Submit three copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of landscape work for an entire year. Submit prior to Notice of Substantial Completion.

F. Chemicals: Submit products, rates of application, and anticipated uses of any pesticides, herbicides, and fumigants.

1.04 QUALITY ASSURANCE

A. Source Quality Control:

1. Submit documentation to the Landscape Architect within ten (10) calendar days after award of the Contract that all plant material is available. The Contractor shall be responsible for all material listed on the plant list. Any and all substitutions due to unavailability must be requested, in writing, prior to confirmation of ordering. All material shall be subject to inspection by the Landscape Architect at any time after confirmation of ordering.

2. Plants shall be subject to inspection and approval of the Landscape Architect at the place of growth, or upon delivery for conformity to the specifications. Such approval shall not impair the right of inspection and rejection during the progress of the work. Inspection and tagging of plant material by the Landscape Architect is for design intent only and does not constitute the Landscape Architect's approval of the plant materials in regards to their health and vigor as specified in Part 2, Section 2.01, M., Plant Material. The health and vigor of the plant material is the sole responsibility of the Contractor. Submit written request for inspection of plant material at the place of growth to the Landscape Architect. Written requests shall state the place of growth and quantity of plants to be inspected. The Landscape Architect reserves the right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.
3. The Contractor shall submit specifications of any item being used on site, upon the request of the Landscape Architect.
4. The Contractor shall obtain and pay for any and all permits and all observations as required.
5. Ordinances and Regulations: All local, municipal, and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and make a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations, or requirements of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver fertilizer to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade mark, and conformance to State law.
2. The Contractor shall furnish the Landscape Architect with copies of receipts for all amendments specified in Section 2.01, Materials, or amended by the Soils Report specified in Section 3.02, Preparation.
3. Deliver all plants with legible identification labels.
   a. Label trees, bundles of containers of like shrubs, or groundcover plants.
   b. State the correct botanical plant name and size indicated on the plant list, on the drawings.
   c. Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 calendar days.
4. Protect plant material during delivery to prevent damage to the root ball or desiccation of leaves.
5. Tarp trees and plant material with canvas, or similar material, during delivery of any length, on any open-air transport.
6. Transporting trees in excess of 20 miles from the site shall be done during evening, night, early morning hours during summer months. The Contractor shall routinely stop the transport and water root balls at pre-determined intervals. Intervals shall be in agreement with the Landscape Architect, as determined in advance of the transport.
7. The Contractor shall notify the Landscape Architect seven (7) calendar days in advance of delivery of all plant materials and shall submit an itemized list of the plants in each delivery.

B. Storage:
1. An on-site location shall be made available for plant material storage. Security and protection of the storage area shall be the Contractor's responsibility.
2. Store plant material in shade and protect from weather.
3. Maintain and protect plant material not to be planted within four (4) hours in a healthy, vigorous condition.
4. Storage of plant materials shall be neat, orderly, and grouped according to like plants.
5. Plant material, upon delivery, shall be inspected for transport damage, disease, and insect infestation. All trees shall be sprayed with a borer preventative or dormant oil, as instructed by the Landscape Architect, within four (4) hours of delivery, IN THE PRESENCE OF THE LANDSCAPE ARCHITECT. Failure to apply the borer preventive to all trees in the presence of the Landscape Architect shall result in the Contractor re-applying the application in the presence of the Landscape Architect, at no additional expense to the Owner. Failure to apply the borer preventative chemical may result in the rejection of all plant material.
6. The Contractor shall be responsible for completely restoring the storage area to the original condition prior to acceptance of construction. Restoration shall occur within seven (7) calendar days of written notification by the Landscape Architect.

C. Handling:
1. The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of plant materials. Plant materials that have been damaged in any way will be discarded, and if installed, shall be replaced with undamaged materials at the Contractor's expense.

1.06 JOB CONDITIONS

A. Perform actual planting only when weather and soil conditions are suitable in accordance with locally accepted practice.

B. Scheduling: Install trees, shrubs, and groundcover before hydraulic seeding or sodding operations are commenced.

1.07 SAMPLES AND TESTS

A. The Landscape Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. The Contractor shall furnish samples upon request by the Landscape Architect. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of the testing of materials not meeting specifications shall be paid by the Contractor.

1.08 MAINTENANCE

A. All stored plant material shall be maintained in a healthy, vigorous condition by the Contractor. Maintenance includes, but is not necessarily limited to, mowing, weeding, edging, watering, trash removal, street and gutter cleaning, erosion repair, removal of siltation in drainage areas, and insect and disease chemical applications. The storage area shall be mowed, weeded, and trimmed weekly during the course of construction and the life of the storage area.

B. Within the limits of construction, the site shall be maintained in a neat, well-kept appearance by the Contractor. Maintenance includes, but is not necessarily limited to, mowing, weeding, edging, watering, trash removal, street and gutter cleaning, erosion repair, removal of siltation in drainage areas, and insect and disease chemical applications.

1.09 GUARANTEE AND REPLACEMENT

A. All plant material installed under the Contract shall be guaranteed against any and all poor, inadequate, or inferior materials and workmanship for a period of 365 calendar days from the date of final acceptance of the construction and maintenance.

B. The guarantee of the Landscape Planting shall be made in accordance with the attached form. A copy of the guarantee form shall be re-typed on to the Contractor's letterhead.

C. A copy of the guarantee form shall have inclusive, any directions or recommendations for maintenance operations for any part or all plant material installed under the Contract. Failure to submit such directions or recommendations shall commit the Contractor unconditionally liable for the health and vigor of the said plant material.

D. The Contractor's directions or recommendations for maintenance operations, along with the guarantee form, shall be filed with the Owner and Landscape Architect, prior to acceptance of the construction and maintenance.

E. The guarantee form shall contain the following information:

GUARANTEE FOR LANDSCAPE PLANTING

We hereby guarantee that the landscape plant material we have furnished and installed is true to the species, variety, size, and conditions specified. All plant material installed under the Contract is guaranteed against any and all poor, inadequate, or inferior materials, and/or workmanship. All plant material installed is pest and disease free at the date of acceptance. We understand that the guarantee is in effect for a period of one (1) year from the date of acceptance, and also replacing of such defects is at no additional cost to the Owner. Plant material lacking vigor and health, or dead, as determined by the Owner, shall be replaced within a reasonable time after receipt of written notice from the Owner. Scheduling of replacements within a reasonable time shall be as determined by the Owner. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Said warranty will become void in the event the property on which the plant material is located, is sold by the Owner.

PROJECT: _____

LOCATION: _____
_____
_____

SIGNED: _____

Signed (printed): _____

COMPANY: _____

ADDRESS: _____
_____
_____

PHONE: (____) _____ -- _____

DATE OF ACCEPTANCE: _____ / _____ / _____

PART 2 -- PRODUCTS

2.01 MATERIALS

A. The following organic, soil amendments and fertilizer are to be used for bid prices basis only. Specific amendments and fertilizer specification will be made after rough grading operations are complete and soil samples are tested by the Owner.

B. All materials shall be of standard, approved, and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original, unopened container bearing the manufacturer's guaranteed analysis. The Contractor shall supply the Landscape Architect with a sample of all supplied materials accompanied by analytical compliance or bearing the manufacturer's guaranteed analysis.

C. Soil Amendment for Tree Planting:
1. Soil for Tree Planting Mix shall be “Tree Mix” supplied by Soil Building Systems, Inc. telephone 972.831.8181, or approved equal.
2. Excavated tree pit soil.

D. Soil Amendment for Shrub and Groundcover Planting:
1. Organic material shall be “Clay Slayer” supplied by Soil Building Systems Inc. telephone 972.831.8181, or approved equal.
2. Planting Fertilizer.
3. Sand shall be clean, coarse, ungraded, meeting the requirments of ASTM C33 for fine aggregates
4. Agricultural Gypsum
5. Soil Sulfur.

E. Fertilizer for Tree Planting:

1. Tree fertilizer shall be water soluble, and shall consist of the following percentages by weight:
20% Nitrogen
20% Phosphoric Acid
20% Soluble Potash

2. Tree fertilizer shall also include the following nutrients:
Boron
Copper
Iron
Manganese
Zinc

F. Fertilizer for Shrub and Groundcover Planting:
1. Planting fertilizer shall be a chemical fertilizer type, containing the following percentages of nutrients by weight:
12% Nitrogen
12% Phosphoric Acid
12% Potash

G. Import Top Soil: Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0 millimeter sieve. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be no greater than 1 part per million as measured on the saturation extract. In order to insure conformance, samples of the import soil shall be submitted to the laboratory for analysis prior to, and following, backfilling.

H. Plant Material:
1. Plants shall be in accordance with the Texas State Department of Agriculture's Regulation for nursery inspections, rules, and ratings. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous, and free of insect infestations, plant diseases, sunscalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well "hardened" systems and vigorous and fibrous root systems which are not root or pot-bound. In the event of disagreement as to the condition of the root system, the root conditions of the plants furnished by the Contractor in containers will be determined by removal of earth from the roots of not less than two (2) plants or not more than two (2) percent of the total number of plants of each species or variety. Where container-grown plants are from several sources, the roots of not less than two (2) plants of each species or variety from each source will be inspected. In case the sample plants inspected are found to be defective, the Landscape Architect reserves the right to reject the entire lot or lots of plants represented by the defective samples. Any plants rendered unsuitable for planting because of this

inspection will be considered as samples and will be provided at the expense of the Contractor.

2. The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock or as specified on the drawings. The minimum acceptable size of all plants measured before pruning with the branches in a normal position, shall conform with the measurements, if any, specified on the drawings in the plant schedule furnished. Plants larger in size than specified may be used with the approval of the Landscape Architect, but the use of the larger plants will make no change in the Contract price. If the use of larger plants is approved, the ball of earth or spread of roots for each plant will be increased proportionately.
3. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and conditions specified herein or as shown on the drawings. Under no conditions will there be any substitutions of plants or sizes listed on the accompanying plans, except with the expressed, written consent of the Landscape Architect.
4. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the Landscape Architect.
5. Plant material shall be true to botanical and common name and variety as specified in the "American Standard of Nursery Stock Editions" and "Standardized Plant Names".
6. Nursery Grown and Collected Stock:
   a. Plant material shall be grown under climatic conditions similar to those in the locality of the project.
   b. Container-grown stock shall be in a vigorous, healthy condition, not root-bound and with the root system hardened off for a period of not less than 12 months.
   c. Use only groundcover plant material which is well established in removable containers or formed homogenous soil sections.
   d. Container-grown trees shall have a root ball measuring 10" of diameter for each 1" of tree caliper. The tree caliper shall be measured on the trunk, 6" above the finish grade or root flare of the tree.
   e. Collected trees shall have a root ball measuring 12" of diameter for each 1" of tree caliper. The tree caliper shall be measured on the trunk, 6" above the finish grade or root flare of the tree.
7. Substitute plant material will not be permitted unless specifically approved, in writing, by the Landscape Architect.

I. Tree Staking:

1. Tree staking shall also be used as approved by Landscape Architect prior to construction using Tree Staple product or approved equal. Tree Stake Solutions, Inc. 281-778-1400.

   a. Root Anchor Safety Stake. Appropriate size shall correspond with gallon size called out on planting plans.
   b. Reference manufacturer’s requirements for installation instructions.

J. Tree Paint:
   1. Morrison Tree Seal, Cabort Tree Paint, or approved equal.

K. Weed Barrier: Weed Barrier product shall be “Weed Barrier Pro” as supplied by DeWitt Company 1-800-888-9669 or approved equal.

L. Water: Source furnished by the Contractor, cost and transport of water, as required, by the Contractor.

M. Mulch material shall be finely groun, fibrous hardwood bark, free from other foreign material, passing a 1 1/2 inch screen

N. Sand: Sharp sand, clean of any debris.

PART 3 -- EXECUTION

3.01 INSPECTION

A. Obtain an Owner's certification that final grades to within 0.10' have been established prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. The Contractor shall be responsible for shaping all planting areas as indicated on the drawings, or as directed by the Landscape Architect.

B. Inspect trees, shrubs, and groundcover plant material for injury, insect infestation, and trees and

shrubs for improper pruning.

C. Do NOT begin planting of trees until deficiencies are corrected or plants replaced.

3.02 PREPARATION

A. Soil Preparation for Trees:
1. After approximate finished grades have been established, the excavated tree pit soil shall be conditioned in the following manner. Amendments shall be uniformly spread and cultivated thoroughly by means of a mechanical tiller:
Application Rates per Tree:
a. “Tree Mix”, or approved equal - one part of mix.
b. Excavated tree pit soil - two parts of mix.
2. At the time of planting, the top two (2) inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one (1) inch in diameter or larger, and shall be free from all wire, plaster, brick, wood, or similar objects that would be a hindrance to planting or maintenance.

B. Soil Preparation for Shrubs, Groundcovers, Seasonal Color areas only:
1. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Amendments shall be uniformly spread and cultivated thoroughly by means of a mechanical tiller, into the top 6" of soil:

Application Rates per 1000 square feet of area:
a. Imported topsoil (2” layer)
b. Clay Slayer, or approved equal (2" layer)
c. Planting fertilizer - 15 pounds
d. Agricultural gypsum - 200 pounds
e. Soil Sulfur - 20 pounds
f. Sand - 3 cubic yards (1" layer)

2. At the time of planting, the top two (2) inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one (1) inch in diameter or larger, and shall be free from all wire, plaster, brick, wood, or similar objects that would be a hindrance to planting or maintenance.

C. Disposal of Excess Soil: Disposal of any unacceptable soil shall be at an off-site location. Disposal of excess soil, acceptable in condition to the Owner, shall be at an on-site location, approved by the Owner.

D. At the time of planting, the top two (2) inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one (1) inch in diameter or larger, and shall be free from all wire, plaster, brick, wood, or similar objects that would be a hindrance to planting or maintenance.

E. At the time of planting or delivery of all trees, the Contractor shall apply a borer preventative or dormant oil (as instructed by the Landscape Architect) to the entire trunk surface and branching structure of each tree. The borer preventative shall be applied to thoroughly saturate the surfaces, to the point of excessive run-off. The Landscape Architect must be present for all applications. Failure on the part of the Contractor to notify the Landscape Architect in advance or apply the borer preventative without the presence of the Landscape Architect, will result in repeated applications, in the presence of the Landscape Architect, at no additional cost to the Owner.

3.03 PLANTING INSTALLATION

A. General:
1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Landscape Architect.
2. Only as many plants as can be planted, staked, and watered on that same day shall be distributed in a planting area.
3. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-Plant Weed Control:
1. If live perennial weeds exist on site at the beginning of the work, spray with a non-

selective, systemic contract herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.

2. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4" below the surface of the soil over the entire area to be planted.
3. After the irrigation system is operational and approved by the Landscape Architect, apply water for five (5) to ten (10) calendar days, as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by the Landscape Architect.
4. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.

C. Lay-Out of Major Planting: Locations for plants and outlines of areas to be planted shall be marked on the ground by the Contractor before any plant pits are dug. All such locations shall be approved by the Landscape Architect. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting may be selected by the Landscape Architect. Lay-out shall be accomplished with flagged grade stakes indicating plant names and specified plant size on each stake. It shall by the Contractor's responsibility to confirm with the Owner, Landscape Architect, and all governing agencies, the location and depth of all underground utilities and obstructions.

D. Planting of Trees and Shrubs:

1. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits, and planting beds.
2. Excess soil generated from the planting holes and not used as backfill or in the establishment of the final grades, shall be removed to an on-site location, as approved by the Owner. Unacceptable excess soil shall be removed to an appropriate off-site location, in a legal fashion.
3. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Existing vegetation identified by the Landscape Architect to remain, shall be protected from trucking operations during the course of construction.
4. Center the plant in the pit or trench.
5. Face plants with the fullest growth into the prevailing wind.
6. Set the plant plumb and hold rigidly in position until the soil has been tamped firmly around the root ball or roots.
7. After the plant has been placed, backfill shall be added to the hole to cover approximately one-half (1/2) the height of the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil. Backfill the remainder of the hole after the water has percolated and is not standing in the hole. Construct a two inch (2") water basin dike around the edge of the hole. The planting shall be immediately irrigated after planting until the entire area is saturated to the full depth of each hole. Install a two inch (2") layer of the specified mulch on top of the root ball.
8. All excavated holes shall have vertical sides with roughened surfaces and shall be of a size that is one and one-half (1 1/2) times the diameter of the root ball for all trees and shrubs. The depths of all excavated holes shall have a roughened pit bottom and shall be of a depth equal to the depth of the root ball or roots for all trees and shrubs.
9. Trees shall be backfilled with a mix specified in Section 3.02 A. 1.
10. Shrubs shall be backfilled with a mix specified in Section 3.02 B. 1.
11. All plants which settle deeper than the surrounding grade shall be raised to the correct level, utilizing the same planting procedure outlined in Section 3.03 D. 7. Care shall be exercised in this operation so as not to damage the plant.
12. Container Removal:
    a. Cut the container on the sides with an acceptable can cutter.
    b. Do not injure the root ball.
    c. After removing the plant from the container, superficially cut the edges of roots with a sharp knife in three (3) equally spaced locations.
13. Ball & Burlap Removal:
    a. Cut off the top 6" of the wire basket. All wire on the root ball with less than a 4" x 4" grid pattern shall be removed entirely and disposed of at an off-site location.
    b. Remove all burlap, rope, twine, and wire from around the plant trunk.
    c. Lay any burlap back approximately 12", exposing a minimum of the top one-third (1/3) of the root ball.
    d. All material or fabric used as a substitution for burlap and is not equal to the degradable qualities of burlap, shall be removed entirely from the root ball and disposed of at an off-site location.
14. Box Container Removal:

a. Remove the bottom of the plant boxes before planting.
b. Place the plant in the pit, position, and backfill to a minimum of one-third the depth of the root ball.
c. Remove the sides of the boxes without damaging the root ball.

15. Fertilize:
    a. Trees:
        1. Fertilize trees by applying one (1) gallon of mix per one (1) foot of tree height. Trees shall be fertilized at the time of the next watering, following the initial watering of the plant material.
        2. Mix one (1) rounded tablespoon of fertilizer concentrate with one (1) gallon of water. Apply one (1) gallon of fertilizer solution for each foot of tree height. Apply only enough fertilizer solution at one time to minimize overflow of the water basis around each tree. APPLY THE FERTILIZER IN THE PRESENCE OF THE LANDSCAPE ARCHITECT. Failure to apply the fertilizer in the presence of the Landscape Architect will result in the Contractor's responsibility to apply a second fertilization, at a time determined by the Landscape Architect, at no additional cost to the Owner.
    b. Fertilize shrubs, groundcover, and seasonal color areas at a rate of two (2) pounds of nitrogen per 1000 square feet of area. Irrigate immediately following the application. Refer Section 3.02 B.
    c. Fertilize turf at a rate of two (2) pounds of nitrogen per 1000 square feet of area. Irrigate immediately following the application. Refer Section 3.03 F., Hydro-Seeding Preparation and Operations, and Section 3.03
16. Pruning: Pruning shall be limited to the minimum necessary to remove injured twigs and branches. All limbs growing in a conflicting, crossing fashion with one another shall be pruned. Pruning may NOT be done prior to the delivery and acceptance of the plant material. Cuts over 3/4" in diameter shall be painted with tree paint. PRUNING SHALL BE DONE ONLY IN THE PRESENCE OF THE LANDSCAPE ARCHITECT.
17. Staking: Staking of all trees shall be completed immediately after planting. All stakes shall be installed plumb, equally spaced, and beyond the root ball. Refer to the drawing details.

E. Planting of Groundcovers:
1. Plants shall be grown in pots as indicated on the drawings. Plants shall remain in those pots until the time of transplanting into the designated areas. The pot's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants from the pot.
2. Groundcover and seasonal color shall be planted in straight rows, evenly spaced, and at spacing called out on the drawings, unless otherwise noted on the drawings. Triangular spacing shall be used unless otherwise noted on the drawings.
3. Each rooted plant shall be planted with its proportionate amount of soil. Planting shall be immediately irrigated after planting until the entire area is saturated to the full depth of each hole.
4. Care shall be exercised at all times to protect the plants after installation. Any damage to the plants by trampling or other operations of this Contract shall be repaired immediately.
5. The Owner and Landscape Architect reserves the right to review and approve all plant material at the nursery or grower.

G. Mulch Cover: All trees, shrubs, groundcover, and seasonal color areas shall be top-dressed with a three (3) inch layer of mulch within 48 hours after planting.

3.04 CLEAN-UP

A. After all planting operations have been completed, remove all trash, excess soil, empty plant containers, rubbish, and all debris associated with this Contract from the site. All scars, ruts, trench settlement, or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. The Contractor shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site, once a week, or the last working day of each week. All trash shall be removed completely from the site.

B. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.

3.05 OBSERVATION SCHEDULE

A. The Contractor shall be responsible for notifying the Landscape Architect in advance for the following site visits, according to the time indicated:
   1. Pre-job Conference - 7 days
   2. Final grade review - 2 days
   3. Plant material review - 2 days
   4. Plant lay-out review - 2 days
   5. Soil Preparation and planting operations - 2 days
   6. Pre-maintenance - 7 days
   7. Final inspection - 7 days

B. When observations are conducted by someone other than the Landscape Architect, the Contractor shall show evidence, in writing, of when and by whom these observations were made.

C. NO site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the Owner. Failure to accomplish punch list tasks or prepare adequately for desired inspections shall make the Contractor responsible for reimbursing the Landscape Architect at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further inspections shall be scheduled until this charge has been paid and received.

END OF SECTION

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established in the North Central Texas Council of Government (NCTCOG) Standard Specifications for Public Works Construction, City Specifications, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
1. Installation of pipe material, fittings and concrete blocking.
2. Construction of fire hydrants, water meters, service lines, gate valves and detector checks.
3. Construction of improvements to City service stub.
4. Coordination with City work forces for extension of water improvements to serve this site.

B. Related Work Specified in Other Sections
1. Section 31 23 33 - Trenching and Backfilling
2. Section 31 00 00 - Earthwork

1.03 COORDINATION

A. Contractor shall coordinate installation of water system with other construction throughout the site.

B. All construction shall conform to NCTCOG and applicable City Standard Specifications for Construction.

C. All work of this Section shall be completed within the limits of the site property boundary or public right-of-way.

1.04 REFERENCES

A. AWWA C900: Requirements for PVC pressure pipe 4" thru 8" pipe
B. AWWA C110 or C907: Ductile Iron Fittings.
C. AWWA C502: Fire Hydrant Installation.
D. AWWA C500: Gate Valves
E. Texas Commission on Environmental Quality (TCEQ), Title 30 Texas Administrative Code (TAC), Chapter 290, “Public Drinking Water”.
Rule §290.38 Definitions
Rule §290.39 General Provisions
Rule §290.44 Water Distribution
Rule §317.13 Appendix E – Separation Distances
F. NSF International NSF/ANSI 61 Drinking Water System Components – Health Effects
G. National Fire Protection Association (NFPA) NFPA 24 Installation of Private Fire Service Mains and Their Appurtenances

1.05 SUBMITTALS

A. Submit manufacturer’s product data sheets to Engineer for review. All pipe, fittings and appurtenances not covered by this specification shall be approved by the engineer 7 days prior to bid.

B. Test Reports: Provide two (2) copies of each field quality control tests including, but not limited to hydrostatic tests, bacteriological tests, infiltration/exfiltration tests, mandrel tests, video camera test, flow test, etc.

C. Contractor is to accurately record installation of piping systems with appurtenances and present the information to Owner at the completion of the project as “Project Record Drawings”.

PART 2 - PRODUCTS

2.01 PIPE

A. Polyvinyl Chloride (PVC) water pipe and fittings with dimension control.

1. PVC Water Pipe, 4” through 12”: AWWA C900, Class 150, DR-18.
2. PVC Fireline Pipe, 4” through 12”: AWWA C900, Class 200, DR-14.

2.02 FIRE HYDRANTS

A. Manufacture and style per City specifications and applicable sections of NCTCOG Item 2.14.

2.03 GATE VALVES

A. Manufacturer, type per City specifications and applicable sections of NCTCOG Item 2.13.

2.04 WATER METERS, DETECTOR CHECK

A. Manufacturer, type per City specifications and applicable sections of NCTCOG Item 2.16.

2.05 METER BOXES, VAULTS

A. Precast/cast-in-place per City specifications, plan details and applicable sections of NCTCOG Item 2.16.

PART 3 - EXECUTION

3.01 GENERAL

A. The locations of all structures and lines and grades of all pipes shall be staked by a registered surveyor. All facilities shall be located according to the site layout plans.

3.02 PIPES

A. All pipe shall be inspected prior to installation. Damaged pipes shall not be used. Replacement of damaged pipe shall be made by the Contractor at no expense to the owner.

B. Pipe installation shall conform to the North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction.

END OF SECTION

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established in the North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction, City and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
1. Installation of pipe material.
2. Construction of manholes.
3. Connection to existing sewer system.

B. Related Work Specified on Other Sections
1. Section 31 23 33 - Trenching and Backfilling
2. Section 33 00 00 - Earthwork

1.03 COORDINATION

A. Verify flowline elevation at connection to existing manhole; notify architect if elevation is more than 0.1' above plan elevation.

B. Coordinate installation with other construction throughout the site.

C. All construction shall conform to NCTCOG and applicable City Standard Specifications for Construction.

1.04 REFERENCES

A. ASTM D3034: Specifications for PVC Sewer Pipe 4" through 15" in diameter.

B. ASTM D2321: Practice for Installation of Underground Installation

1.05 SUBMITTALS

A. All pipe and fittings not covered by this specification shall be approved by the engineer seven days prior to bid.

PART 2 - PRODUCTS

2.01 PIPE

A. Polyvinyl Chloride (PVC) sewer pipe and fittings with dimension control.

1. Pipe shall be SDR-26.
2. Pipe Fittings: Pipe fittings shall conform to ASTM D1784. Fittings approved by the Engineer shall also be acceptable.
3. Balance of specifications shall be covered by Item 2.12.14 per NCTCOG.

2.02 Structures

A. Materials for the construction of manholes shall be as specified in Division 7, "Concrete Structures" of the NCTCOG's Standard Specifications for Construction.

PART 3 - EXECUTION

3.01 GENERAL

A. The locations of all structures and lines and grades of all pipes shall be staked by a registered surveyor. All facilities shall be located according to the site layout plans.

B. Contractor shall utilize necessary measures including temporary pumping and collection until the public sewer improvements are installed and operational.

3.02 PIPES

A. All pipe shall be inspected prior to installation. Damaged pipes shall not be used. Replacement of damaged pipe shall be made by the Contractor at no expense to the owner.

B. Installation shall be in accordance with NCTCOG and City specifications and as recommended by the pipe manufacturer. Backfill shall be per plans.

3.03 STRUCTURES

A. Construction of manholes shall be as specified in Division 7, “Concrete Structures” of NCTCOG and the City Standard Specifications for Construction.

B. Connections of pipe to structures shall be completely mortared around the perimeter of the pipe to ensure connection to the structure prior to backfilling. Pipe shall have a rubber boat placed over the end prior to pouring concrete structure or grouting.

C. All manholes in pavement areas shall be held below pavement and the frame/lid shall be adjusted to final grade with grade rings. There should be no abrupt grade changes at manholes rims. **If abrupt grade changes are present, grade adjustments will be required.**

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
1. Installation of pipe material.
2. Construction of drainage system structures including curb inlets, junction boxes and catch basins.
3. Ditch-out for storm drainage system discharge.

B. Related Work Specified in Other Sections
1. Section 31 23 33 - Trenching and Backfilling
2. Section 31 00 00 - Earthwork

1.03 COORDINATION

A. Contractor shall coordinate installation of drainage system with other construction throughout the site.

B. All construction shall conform to applicable City Specifications for Construction.

C. All work of this Section shall be completed within the limits of the site property boundary or designated offsite easements.

1.04 REFERENCES

A. ASTM C76: Specification for Reinforced Concrete Pipe.
B. AASHTO M294 HDPE Pipe
C. ASTM F477 HDPE Fittings

1.05 SUBMITTALS

A. All pipe and fittings not covered by this specification shall be approved by the engineer seven days prior to bid.

PART 2 - PRODUCTS

2.01 PIPE

A. Reinforced concrete pipe shall be Class III.

B. Plastic pipe shall be PVC SDR35 or Schedule 40 or HDPE heavy wall meeting the requirements of AASHTO M294 and ASTM F477 with corrugated exterior with smooth lined interior. All pipe joints shall be silt tight with all fittings watertight

C. ADS HP Storm polypropylene pipe (dual wall) meeting the requirements of AASHTO M330, ASTM F2736 and ASTM F2881 with smooth inner wall and annular exterior corrugations.

2.02 DRAINAGE STRUCTURES

A. Materials for the construction of inlets and junction boxes shall be as specified in Division 7, "Structures" of the NCTCOG's Standard Specifications for Construction.

PART 3 - EXECUTION

3.01 GENERAL

A. The locations of all structures and lines and grades of all pipes shall be staked by a registered surveyor. All facilities shall be located according to the site layout plans.

B. Contractor shall utilize necessary measures, including temporary pumping in order to drain storm water offsite until the public drainage improvements are installed and operational.

3.02 PIPES

A. All pipes shall be inspected prior to installation. Damaged pipes shall not be used. Replacement of damaged pipe shall be made by the Contractor at no expense to the owner.

B. Installation shall be in accordance with ASTM D2321 and as recommended by the pipe manufacturer. Backfill shall be ASTM D2321 Class I, II or III soils.

C. Pipe installation shall conform to the North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction & City specifications.

D. Concrete collars shall be constructed where there is a change in pipe material

3.03 DRAINAGE STRUCTURES

A. Construction of curb inlets tops, manholes tops and catch basins in pavement areas shall be **cast-in-place only** with **no precast structures allowed**. Catch basins and headwalls shall be either cast-in-place or precast.

B. Connections of pipe to structures shall be completely mortared around the perimeter of the pipe to ensure watertight connection to the structure prior to backfilling. All bends and tees shall be precast/preformed.

C. Inlet top and throat shall be poured once pavement improvements are in place.

END OF SECTION

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