Request for Competitive Sealed Proposal

UNT New Dining Hall Retail Space Buildout

RFCSP769-21-249969ER
UNT RETAIL
2016233-003

ISSUED FOR CONSTRUCTION
5 APR 2021
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DOCUMENT 000107.1 - ARCHITECT SEAL PAGE

All sections identified on the Table of Contents with a suffix of (A) have been furnished by the Architect for this Project:

KIRKSEY

REGISTERED ARCHITECT
STATE OF TEXAS
STEPHEN E. DURHAM
15134
07 APRIL 2021
DOCUMENT 000107.5 - MEP SEAL PAGE

All sections identified on the Table of Contents with a suffix of (MEP) have been furnished by PURDY-MCGUIRE INC. (Mechanical, Electrical or Plumbing Engineer) for this Project:

MECHANICAL SEAL

ELECTRICAL SEAL

PLUMBING SEAL
DOCUMENT 000107.7 – TECHNOLOGY SEAL PAGE

All sections identified on the Table of Contents with a suffix of (T) have been furnished by 4B TECHNOLOGY GROUP (AV, Data, Security) for this Project:

[Signature]

BICSI

GEOFFREY D. BASFORD
REG. NO. 143410
EXPIRES 12-31-2021
In accordance with Education Code 51.783, the University of North Texas System (UNTS), subsequently referred to as Owner, is accepting proposals and intends to enter into an agreement with a vendor that specializes in General Construction in accordance with the terms and conditions and requirements set forth in this RFCSP. Sealed proposals for RFCSP752-21-249969ER will be received by the Owner at the Business Service Center (BSC), Woodhill Square, 1112 Dallas Drive, Suite 4000, Denton, Texas 76205. A campus map can be found online at http://maps.unt.edu/?code=WHS. Parking for Woodhill Square is campus parking and permits are required. There is guest parking at the door to Suite 4000 and only those spaces can be utilized for submitting the proposal. Proposers are responsible for all parking costs and for complying with parking regulations. Failure to comply with parking regulations may result in citation and possible impound of vehicle.

Proposals will be received up to 2:00p.m. CDT on June 14, 2021. HUB Sub-contracting Plans must be received twenty-four (24) hours later up to 2:00p.m. CDT on June 15, 2021. Proposals received after the date and hour above stated will not receive consideration. Proposals will then be publicly opened and read aloud promptly at 2:00p.m. CDT on June 18, 2021 via Teams meeting:

Microsoft Teams meeting
Join on your computer or mobile app
Click here to join the meeting
Or call in (audio only)
+1 940-304-2772,,660848074# United States, Denton
Phone Conference ID: 660 848 074#
Find a local number | Reset PIN
Learn More | Meeting options

Project Description
This project is for the build out of the retail space at the newly built dining hall, Eagle Landing. The retail space is approximately 2,700 gross square feet (GSF). It is consistent with the institution’s strategic land and campus master plan. The facility includes market area, coffee/bakery server and Which Wich server along with associated kitchen, preparation, storage, wash room, and other necessary support areas for a modern retail facility. The retail space is to provide the students and faculty a unique experience of a coffee shop and market, by the use of its materials, rich warm wood porcelain tile tones, and patina metal porcelain tile tones, in an intimate setting with lots of natural light.

Questions
Questions concerning this proposal should be directed to:

Elaine Robbins
Construction Solicitation Coordinator
University of North Texas System
Office of Facilities Planning and Construction
Elaine.Robbins@untsystem.edu

All questions must be received no later than 2:00p.m. CDT on June 2, 2021. All questions and answers will be posted to the website by 5:00p.m. CDT on June 4, 2021.
The Owner may in its sole discretion respond in writing to questions concerning this Proposal. Only the Owner’s responses made by formal written Addendum to this Proposal shall be binding and shall be posted on the BSC’s website located at https://www.untsystem.edu/bid-opportunities. Oral or other written interpretations or clarifications shall be without legal effect.

Pre-Proposal Meeting

The pre-proposal meeting will be held via Microsoft Teams at 10:30am. CDT on May 19, 2021.

Microsoft Teams meeting
Join on your computer or mobile app
Click here to join the meeting
Or call in (audio only)
+1 940-304-2772,,547143996# United States, Denton
Phone Conference ID: 547 143 996#
Find a local number | Reset PIN
Learn More | Meeting options

Site Visit: Site tours will be conducted on May 21, 2021 beginning at 9:00am. These will be no more than 30 minute site tours. Tour group size will be limited to no more than ten (10) people including UNTS representatives. PPE (face masks) will be required to be worn at all times while on the UNT campus. See Document 002100, Instructions for Proposal, Item 1, for more information for schedule of times and contact information.

Bid Documents

Proposers may obtain or access plans, specifications, and addenda for this project through the following sources:


Plan Rooms with bid documents on file include: McGraw-Hill Construction Plan Center (Irving), ABC Plan Room (Irving), DFW Minority (Dallas), AGC TEXO and iSqFt Plan Room (Dallas). Contact information for the plan rooms can be found at http://www.untsystem.edu/unt-plan-rooms.

Historically Underutilized Business (HUB)

In accordance with Texas Government Code 2161, RFCSP for contracts with an expected value of $100,000 or more will require HUB Subcontracting Plan. All subcontracted work whether identified by the Owner or not, are required to be identified in the HUB Subcontracting Plan. The Plan should reflect all subcontracting opportunities to be utilized in this project and can be found online at (http://www.window.state.tx.us/procurement/prog/hub/hub-forms/hub-sbcont-plan--allfms.pdf). Complete, print, sign and submit the HUB Subcontracting Plan form with the proposal response.

Only RFCSP responses with approved HUB Subcontracting Plans will be opened. Please return the HUB Subcontracting Plan in a clearly marked envelope, separate from your RFCSP response. Only one (1) hard copy of the HUB plan is required with your response.

Questions regarding the completion of the HUB Subcontracting Plan should be directed to Greg Obar or Aurika Weaver-White at hub@untsystem.edu.

The Owner is not bound to accept the lowest priced offer if that offer is not in its best interest, as determined by the Owner. The Owner reserves the right to: (a) enter into agreements or other contractual arrangements for all or any portion of the Scope of Work set forth in this Proposal with one or more respondents; (b) reject any and all offers and re-solicit offers; or (c) reject any and all offers and temporarily or permanently abandon this procurement, if deemed to be in the best interest of the Owner.

END OF SECTION
University of North Texas System (UNTS), subsequently referred to as the Owner, is accepting sealed proposals from contractors for a General Construction project, pursuant to Sec. 51.783, Texas Education Code, in accordance with the terms and conditions and requirements set forth in this Request for Competitive Sealed Proposal (RFCSP).

1. VIRTUAL PRE-PROPOSAL MEETING:

A pre-proposal meeting will be conducted to answer any questions regarding the scope of the project and the submission of the HUB Subcontracting Plan. Attendance is not mandatory but highly recommended. The pre-proposal meeting will be held:

May 19, 2021 at 10:30 a.m. CDT via Microsoft Teams

Microsoft Teams meeting
Join on your computer or mobile app
Click here to join the meeting
Or call in (audio only)
+1 940-304-2772, 547143996#
United States, Denton
Phone Conference ID: 547 143 996#
Find a local number | Reset PIN
Learn More | Meeting options

SITE VISIT: A site visit will be conducted for contractors and sub-contractors to see the space in the Dining Hall for buildout on May 21, 2021. Tour group size will be limited to no more than 10 people (including UNTS representatives) at one time, so please, only consider those individuals from your company that are absolutely necessary to attend.

PPE (face masks) will be required to be worn at all times while on the UNT campus.

Site visit times will be no longer than 30 minutes each. This will be the only scheduled times to view the site as follows:

9:00 a.m. – 9:30 a.m. – 1st tour
9:35 a.m. – 10:05 a.m. – 2nd tour
10:10 a.m. – 10:40 a.m. – 3rd tour
10:45 a.m. – 11:15 a.m. – 4th tour
11:20 a.m. – 12:10 p.m. - 5th tour

Please contact Elaine Robbins at elaine.robbins@untsystem.edu to schedule a time for a tour. Unless you have been signed up for a specific time slot, you can not just show up for a tour. All parties will need to be on the list to tour the site.

2. PROJECT PROPOSED SCHEDULE

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<td>06/14/2021</td>
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<td>Deadline for Submission of Proposal</td>
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<td>06/18/2021</td>
<td>2:00 p.m.</td>
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3. GENERAL REQUIREMENTS

3.1 Pricing

Your proposal must include all labor, material, equipment and services necessary to complete the work required by the construction documents. Pricing reflects the full Scope of Work defined herein; inclusive of all associated cost for delivery, labor, insurance, taxes, overhead and profit, or as otherwise defined, as appropriate. The Contractor shall base their base proposal price on the set of 100 percent Construction Documents and Specification. Contractor must complete Division 00, Section 004100, Proposal Form. Proposal must also include all alternates.

3.2 Unit Prices

When requested, Respondents must price per unit shown. Unit prices shall govern in the event of extension errors. Respondents must give unit prices for each item to be purchased. An “All or None” response by Respondent may be rejected at the option of the Owner. Quote F.O.B destination, freight prepaid and allowed. Otherwise, specify exact delivery cost and terms.

3.3 Schedule

Time is of the essence in the performance of the Contractor’s duties. It is critical that a realistic expedited schedule is provided.

3.4 Purchasing Items

A. Catalogs, brand names or manufacturer’s references are descriptive only, and indicate type and quality desired. Substitution requests of like nature and quality will be considered if response specifies such. If responding on other than referenced, response should show manufacturer, brand or trade name, and other description of product offered. If other than brand(s) specified is offered, illustrations and a complete description of product offered are requested to be made part of the response. Failure to take exception to specifications or reference data will require respondent to furnish specified brand names, numbers, etc.

B. Unless otherwise specified, all material shall be new and unused.

C. In addition, all electrical items must meet all applicable state and federal standards and regulations, and bear the appropriate listing such as ANSI, FCC, NEMA, NTRL, and OSHA standards.

D. Samples, when requested, must be furnished free of expense to the Owner. If not destroyed in examination, they will be returned to Respondent, on request, at Respondent’s expense. Each sample should be marked with Respondent’s name, address, and requisition number. Do not enclose in or attach offer to sample.

E. A one (1) year warranty from substantial completion is required.

F. Delivery

i. Show number of days required to complete project under normal conditions.

ii. No substitutions permitted without written approval of Owner.

G. Inspection and Tests

All work will be subject to inspection and test by the Owner. All costs shall be borne by the respondent in the event of failed inspection or tests.

3.5 Eligible Respondents

Only individual firms or formal joint ventures may apply. Two (2) firms may not apply jointly unless they have formed a joint venture. Any associates will be disqualified. (This does not preclude a respondent from having consultants.)
4.1 Submit a total of two (2) complete copies of the entire response. Please submit one (1) unbound paper copy plus one (1) copy on labeled flash drive. Both formats MUST include the exact same information. Missing information from either format may result in the Owner’s rejection of the response. It is not necessary to include your HUB Sub-Contracting Plan on the flash drive. Please be sure to combine your proposal documents to one file. No QR codes will be accepted as part of your response and may disqualify your response. An original signature must appear on the Proposal Form (Division 00, Section 004100).

A. The materials submitted must be enclosed in a sealed envelope, box, or container; the package must show clearly the proposal deadline; the RFCSP name must be clearly visible; and name and the return address of the Contractor must be clearly visible.

NOTE: Show the RFCSP name and submittal date in the lower left-hand corner of your sealed proposal envelope (box/container).

B. Late proposals will not be considered under any circumstances.

C. The Owner reserves the right to accept late proposals; however, proposals received after opening time will not be accepted.

D. Facsimile (“FAX”) or emailed proposals are not acceptable.

The Proposal must be submitted no later than 2:00p.m. CDT on June 14, 2021. Proposals received after the date and hour previously stated will not receive consideration. The HUB Sub-Contracting Plan must be submitted no later than 2:00p.m. CDT on June 15, 2021. Failure to submit the HUB Sub-contracting plan will disqualify your proposal.

TO: Elaine Robbins
Construction Solicitation Coordinator
University of North Texas System
Business Service Center
Woodhill Square
1112 Dallas Drive, Suite 4000
Denton, Texas 76205

Individual hand deliveries will be accepted from 8:00a.m. to 2:00p.m. Note that the BSC is closed from 12:00p.m. noon to 1:00p.m. for lunch.

Proposals & HUB Plans will be received until the date and time established for receipt. The names of the respondents who submitted proposals will be made public. A virtual public opening shall be held on June 18, 2021 promptly at 2:00p.m. CDT via Microsoft Teams meeting.

Microsoft Teams meeting
Join on your computer or mobile app
Click here to join the meeting
Or call in (audio only)
+1 940-304-2772, 660848074# United States, Denton
Phone Conference ID: 660 848 074#
Find a local number | Reset PIN
Learn More | Meeting options

4.2 After proposals are received in response hereto, and notice of intent to award a contract is made, the successful Contractor will be required to enter into a contract in the form of the Owner’s standard General Construction/Demolition Agreement. The Contractor should review the contract (Division 00, Section 005200, Agreement Forms). No changes to the standard contract will be accepted.

Any questions or concerns regarding this Request for Proposals shall be directed to:
Elaine Robbins - Construction Solicitation Coordinator  
University of North Texas System  
Office of Facilities Planning and Construction

Please submit solicitation questions to:  
Elaine.Robbins@untsystem.edu

All questions must be received no later than June 2, 2021 at 2:00p.m. CDT. All questions and answers will be posted to the website by 5:00pm CDT, June 4, 2021.

The Owner specifically requests that Respondents restrict all contact and questions regarding this RFCSP to the above named individual except as provided in 4.2 above.

Responses to inquiries which directly affect an interpretation or change to this RFCSP will be issued electronically by addendum (amendment) and posted at: https://www.untsystem.edu/bid-opportunities and http://www.txsmartbuy.com/sp.

All such addenda issued by the Owner prior to the time that proposals are received shall be considered part of the RFCSP, and the Respondent shall be required to consider and acknowledge receipt of such on the proposal form. Contractors are responsible for obtaining any addenda posted on the websites listed above.

Only those inquiries the Owner replies to which are made by formal written addenda shall be binding. Oral and other interpretations or clarifications will be without legal effect. The Respondent must acknowledge all addenda in Division 00, Section 004100, Proposal Form.

4.3 Compliance with Law

Contractor is aware of, is fully informed about, and in full compliance with its obligations under existing applicable law and regulations, including Title VI of the Civil Rights Act of 1964, as amended (42 USC 2000(D)), Executive Order 11246, as amended (41 CFR 60-1 and 60-2), Vietnam Era Veterans Readjustment Act of 1974, as amended (41 CFR 60-250), Rehabilitation Act of 1973, as amended (41 CFR 60-741), Age Discrimination Act of 1975 (42 USC 6101 et seq.), Non-segregated Facilities (41 CFR 60-1), Omnibus Budget Reconciliation Provision, Section 952, Fair Labor Standards Act of 1938, Sections 6, 7, and 12, as amended, Immigration Reform and Control Act of 1986, and Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals (PL 96-507), the Americans with Disabilities Act of 1990 (42 USC 12101 et seq.), the Civil Rights Act of 1991, and all other laws and regulations and executive orders as are applicable.

4.4 University’s Right to Audit

At any time during the term of any Contract resulting from this solicitation and for a period of four (4) years thereafter, the Owner or a duly-authorized audit representative of the Owner or the State of Texas, at its expense and at reasonable times, reserves the right to audit Contractor’s records and books relevant to all services provided under this Contract. In the event such an audit by the Owner reveals any errors/overpayments by the Owner, Contractor shall refund 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 owing the Owner from any payments due Contractor.

4.5 Access to Documents

To the extent applicable to this procurement, in accordance with Public Law 99-499 under TEFRA, Contractor agrees to allow, during and for a period of not less than four (4) years after the Contract term, access to this Contract and its books, documents, and records; and contracts between Contractor and its subcontractors or related organizations, including books, documents and records relating to same, by the Comptroller General of the United States, the U.S. Department of Health and Human Services, and their duly authorized representatives.

4.6 Insurance and Bonds
The Contractor shall provide and maintain insurance, performance bond, and payment bond as required. The minimum insurance coverage and bonding requirements are stated in Division 00, Section 007000, UGC.

The Owner is considering obtaining Builders Risk Insurance for the project through the State Office of Risk Management. All other Contractor provided insurance requirements would remain unchanged.

4.7 Other Benefits

It is understood and agreed that no benefits, payments or considerations received by Contractor for the performance of services associated with and pertinent to the resultant Agreement shall accrue, directly, or indirectly, to any employees, elected or appointed officers or representatives, or any other person identified as agents of, or who are, by definition, an employee of the State.

4.8 Non-Disclosure

Contractor and Owner acknowledge that they or their employees may, in the performance of the resultant Contract, come into the possession of proprietary or confidential information owned by or in the possession of the other. Neither party shall use any such information for its own benefit or make such information available to any person, firm, corporation, or other organization, regardless of whether directly or indirectly affiliated with Contractor or Owner, unless (i) required by law, (ii) required by order of any court or tribunal, (iii) such disclosure is necessary for the assertion of a right, or defense of an assertion of a right, by one party against the other party hereto, or (iv) such information has been acquired from other sources.

4.9 Publicity

Contractor agrees that it shall not publicize this potential Contract or disclose, confirm or deny any details thereof to third parties or use any photographs or video recordings of the Owner’s employees or use the Owner’s name in connection with any sales promotion or publicity event without prior written approval.

4.10 Assignment

The potential agreement with Contractor resulting from this RFP is a personal service contract for the services of Contractor, and Contractor’s interest in such agreement, duties thereunder and/or fees due thereunder may not be assigned or delegated to a third party without the Owner’s prior written consent. The benefits and burdens of such agreement are, however, assignable by the Owner.

4.11 Assignment of Overcharge Claims

Contractor hereby assigns to the Owner any and all claims for overcharges associated with the Contract arising under the antitrust laws of the United States, 15 U.S.C.A., Sec. 1 et seq. (1973), or arising under the antitrust laws of the State of Texas, Texas Business and Commerce Code Annotated, Sec. 15.01, et seq. (1967).

4.12 Patent and Copyright

Contractor shall pay for any royalties, license fees, copyrights or trade and service marks required to perform the services required by any resulting Contract.

4.13 Texas Public Information Act

The Owner considers all information, documentation and other materials requested to be submitted in response to this solicitation to be of a non-confidential and/or non-proprietary nature and therefore shall be subject to public disclosure under the Texas Public Information Act (Texas Government Code, Chapter 552.001, et seq.) after a contract is awarded.

Respondents are hereby notified that the Owner strictly adheres to all statutes, court decisions, and opinions of the Texas Attorney General regarding the disclosure of RFP information.

4.14 Freedom of Access and Use of Facilities
Contractor’s employees shall have reasonable and free access to use only those facilities of the Owner that are necessary to perform services under a resulting Contract and shall have no right of access to any other facilities of the Owner.

4.15 Observance of University Rules and Regulations

Contractor agrees that at all times its employees will observe and comply with all regulations of the facilities, including but not limited to, no smoking, parking and security regulations.

4.16 Section Heads

All section headings are for convenience of reference only and are not intended to define or limit the scope of any provisions of this RFCSP.

4.17 Governing Law

A. This RFCSP, and any resulting Contract, agreement or purchase order shall be construed and governed by the laws of the State of Texas.

B. The parties understand and agree that any purchase order/contract may be subject to the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the administrative regulations and/or guidance which have been issued or may in the future be issued pursuant to HIPAA, including, but not limited to, the Department of Health and Human Services regulations on privacy and security, and Texas state laws pertaining to medical privacy (collectively, “Privacy Laws”). Vendor agrees to comply with all Privacy Laws that are applicable to this purchase order/contract and to negotiate in good faith to execute any amendment to this purchase order/contract that is required for the terms of this purchase order/contract to comply with applicable Privacy Laws. In the event the parties are unable to agree on the terms of an amendment pursuant to this paragraph within thirty (30) days of the date the amendment request is delivered by one party to the other, this order may be terminated by either party upon written notice to the other party.

C. Important Notice: Any purchase order may be funded wholly or partially with federal funds subject to the American Recovery and Reinvestment Act of 2009 (ARRA). The vendor shall comply with all applicable provisions of ARRA, which may include, but are not limited to, the provision of Division A, Titles XV and XVI (e.g., audit provisions, whistleblower protection, and preferences for American products).

D. Federal Funds: All procurements of supplies equipment, and services utilizing Federal Funds (e.g., Federal Grant or Contract) shall be made in accordance with all applicable federal rules and regulations: Federal Acquisition Regulations (FAR), Federal Office of Management and Budget (OMB) Educational Institutions, even if part of a State or local government follow: OMB A-21 for cost principles, A-110 for administrative requirements, and A-133 for audit requirements. All procurement requirements contained in the above referenced circulars are incorporated herein by reference. By signing this solicitation document, vendor certifies that vendor is in compliance with OMB A-110 and that vendor is not on the Debarred Bidders List.

4.18 Owner’s Special Conditions

The Owner requires full compliance with Division 00 and Division 01 Specifications, Contract and General Requirements. The documents shall be a part of this RFCSP and the Contract.

4.19 Prevailing Wage Schedule, University of North Texas System

Prevailing wage schedule shall in accordance with Texas Government Code, Chapter 2258. The hourly wage rate for work over forty (40) hours a week and work on legal holidays shall be not less than one and one-half (1.5) times the hourly rates.

Respondents shall base their proposals on rates they expect to pay. The Owner will not consider claims for extra payment to the Contractor on account of payment of wages higher than those required by Texas Government Code, Chapter 2258.

4.20 Pursuant to Section 231.006 of the Family Code, response must include names and social security
numbers of each person with at least twenty-five (25) percent ownership of the business entity submitting the response. Vendors that have pre-registered this information on the Texas Comptroller of Public Accounts Centralized Master Bidders List (CMBL) have satisfied this requirement. If not pre-registered, list the name and social security numbers for each person. Otherwise, this information must be provided prior to contract award.

4.21 Note to Vendors: Any terms and conditions attached to any response will not be considered unless specifically referred to on the Solicitation and may result in disqualification of the response.

A. Dispute Resolution: Chapter 2260 of the Texas Government Code establishes a dispute resolution process for contracts involving goods, services, and certain types of projects. If Chapter 2260 applies to this Purchase Order, then the statutory dispute resolution process must be used by the vendor to attempt to resolve all of its disputes arising under this Purchase Order.

B. Excess Obligations Prohibited: The Texas Constitution (Article XVI, Section 10) prohibits obligators beyond the current appropriations, which the Owner applies annually. Any purchase order may be canceled at any time without penalty if legislative and/or Owner funds are not appropriated for goods or services obligated on any purchase order beyond the current fiscal year (September 1 through August 31 of any given year.)

C. Cancellation: Items or orders may be canceled without the consent of the vendor due to failure to fulfill their contractual obligations. If cancellation is requested by the Owner for some other reason through no fault of the vendor, the vendor will be contacted. The Owner reserves the right to cancel this contract upon thirty (30) days written notice to the Contractor. The Contractor must request and secure in writing the approval of the Purchasing Department to be released from this contract or any portion thereof should conditions unforeseeable occur.

D. Miscellaneous: The laws of the State of Texas shall prevail, including the Public Information Act. Any Order is not confidential. All transactions associated with this Order may be subject to audit. Vendor, by accepting this Order agrees to allow access to all records regarding this transaction upon written request by UNTS Internal Auditors and/or UNTS Business Support Services Procurement department.

5. EVALUATION

5.1 The successful offer will be the offer that is submitted in response to this Proposal by the Submittal Deadline and provides the Best Value to the Owner in the Owner’s sole discretion. Offers will be evaluated by an evaluation committee that will include employees of the Owner and other persons invited by the Owner to participate. The evaluation of offers and the selection of the Successful Offer will be based on the information provided to the Owner by the respondent in response to the Specifications section of this Proposal. Consideration may also be given to any additional information and comments if such information or comments increase the benefits to the Owner. The successful respondent will be required to enter into a contract acceptable to the Owner.

The evaluation committee will determine if Best and Final Offers are necessary. Award of a contract may be made without Best and Final Offers. The Owner may, at its discretion, elect to have Respondents provide oral presentations and respond to inquiries from the evaluation committee related to their Proposals. A request for a Best and Final Offer is at the sole discretion of the Owner and will be extended in writing.

In evaluating Proposals to determine the best value for the State, the Owner may consider information related to past contract performance of a Respondent including, but not limited to, Texas Comptroller of Public Account’s Vendor Performance Tracking System.

5.2 Evaluation Criteria

Proposals will be opened publicly to identify the names of the proposers and their respective proposed agreement amounts. Other contents of the Proposals will be afforded security sufficient to preclude disclosure of the contents prior to award. Proposals will be evaluated by the Owner. The criteria for evaluation, Best Value determination using Education Code 51.783 and selection of the successful proposer for this award, will be based upon the equally weighted factors listed below:
A. Proposed agreement amount listed on Proposal form.
B. Proposed number of calendar days indicated on Proposal form.
C. The qualifications and experience of the proposer’s key personnel and subcontractors committed to the project. Experience with construction of dining retail facilities or similar, providing experience and capabilities on completed projects similar in scope, size, complexity and schedule along with previous experience with new construction on a University campus with heavy foot and vehicular traffic.
D. Proposer’s current workload and availability of personnel and equipment.
E. The quality of references from owners and architects for similar projects completed by the proposer within the last five (5) years.
F. The proposer’s proposed project schedule and the demonstrated ability to have met expedited schedules on similar projects.
G. The proposer’s safety record.
H. The proposer’s plan/protocols as related to COVID19 safety measures.
J. The sufficiency of the proposer’s financial resources.

6. AWARD PROCESS

6.1 After the opening of the offers and upon completion of the initial review and evaluation of the offers submitted, selected respondents may be invited to participate in oral presentations. The selection of the Successful Offer may be made by the Owner on the basis of the offers initially submitted, without discussion, clarification or modification. In the alternative, selection of the Successful Offer may be made by the Owner on the basis of negotiation with any of the respondents. At the Owner’s sole option and discretion, it may discuss and negotiate all elements of the offers submitted by selected respondents within a specified competitive range. For purposes of negotiation, a competitive range of acceptable or potentially acceptable offers may be established comprising the highest-rated offers. The Owner will provide each respondent within the competitive range with an equal opportunity for discussion and revision of its offer. The Owner will not disclose any information derived from the offers submitted by competing respondents in conducting such discussions. Further action on offers not included within the competitive range will be deferred pending the selection of the Successful Offer; however, the Owner reserves the right to include additional offers in the competitive range if deemed to be in its best interest.

After the submission of offers but before final selection of the Successful Offer is made, the Owner may permit a respondent to revise its offer in order to obtain the respondent’s best final offer. The Owner is not bound to accept the lowest-priced offer if that offer is not in its best interest, as determined by the Owner.

The Owner reserves the right to: (a) enter into agreements or other contractual arrangements for all or any portion of the Scope of Work set forth in this Proposal with one or more respondents; (b) reject any and all offers and re-solicit offers; or (c) reject any and all offers and temporarily or permanently abandon this procurement, if deemed to be in the best interest of the Owner.

6.2 Respondent’s Acceptance of Evaluation Methodology

Submission of an offer by a respondent indicates: (1) the respondent’s acceptance of the Selection Process, the Evaluation of Criteria for selection, and all other requirements and specifications set forth in this Proposal; and (2) the respondent’s recognition that some subjective judgments must be made by the Owner during this Proposal process.

6.3 Contract

A. A response to this Solicitation is an offer to contract based upon the terms, conditions and specifications contained herein. Responses do not become contracts until a UNTS Agreement is issued and accepted. The contract shall be governed, construed, and interpreted under the laws of the State of Texas as the same may be amended from time to time. The Education Code 51.9335 shall be considered in making an award when specified. Venue for any suit filed against UNTS shall be subject to the mandatory venue statute set forth in §105.151 of the Texas Education Code.

i. An award is made to the Vendor submitting the lowest and/or best value response conforming to this specification. To determine the lowest and/or best value response, in addition to price, BEST VALUE may be considered.
ii. DEBTS TO THE STATE: Any party indebted to the State of Texas or any party who is more than thirty (30) days delinquent for Child Support is not entitled to payment on this purchase order or any accompanying contract.

iii. If a "best offer" vendor shows not to be in "good standing," this agency may reject the response and award to the next best response.

iv. The Owner reserves the right to award the entire contract to a single Vendor or to award different components to different Vendors, whichever the Owner, at its sole discretion, determines to be in its overall best interest, as solely determined by the responsible parties of the Owner.

B. Respondent understands that acceptance of funds under this contract acts as acceptance of the authority of the State Auditor’s Office, or any successor agency, to conduct an audit or investigation in connection with those funds. Respondent further agrees to cooperate fully with the State Auditor’s Office or its successor in the conduct of the audit or investigation, including providing all records requested. Respondent will ensure that this clause concerning the authority to audit funds received indirectly by subcontractors through proposer and the requirement to cooperate is included in any subcontract it awards.

6.4 Response Results: It is not the policy of the Owner to furnish results over the telephone. Bid tabulations may be requested by email to Elaine.robbins@untsystem.edu.

6.5 Historically Underutilized Businesses (HUB)

A. If Owner elects to award the future Construction Phase Services to the Construction Manager, the proposed contract is expected to exceed $100,000.00. A Good Faith Effort Program in the form of a HUB Subcontracting Plan (HSP) is a mandatory condition precedent to the award of any such extension of the contract. The HSP will become a part of the General Construction Agreement. Refer to Division 00, Section 006000, Project Forms herein for HSP Forms.

B. Centralized Master Bidders List (CBML): The Owner utilizes the Texas Comptroller of Public Accounts CBML for HUB. The CBML is located at: http://comptroller.texas.gov/purchasing/vendor/cbml/. Non-HUB respondents are identified from various sources including the CBML.

C. Questions regarding completing the HSP should be directed to Greg Obar, Senior Director of Strategic Management & HUB Coordinator, or Aurika Weaver-White, HUB Specialist at hub@untsystem.edu. Additional information can also be found at the Texas Comptroller for the Public Accounts website at: http://www.window.state.tx.us/procurement/prog/hub/hub-forms/.

FAILURE TO MEET HUB REQUIREMENTS MAY RESULT IN THE TERMINATION OF THE CONTRACT.

END OF SECTION
DOCUMENT 003132

GEOTEchnical DATA

1.1 SUMMARY
A. This document includes information pertaining to geotechnical data.

1.2 INVESTIGATION
A. An investigation of subsurface soil conditions at the building site was authorized by the Owner, and was subsequently performed by Fugro USA Land, Inc., project number 04.40171085, dated April 18, 2018.

1.3 REPORT
A. The Geotechnical Investigation Report is for information only, and is not a warranty of subsurface conditions.
B. The Report is made available for information only.
C. The information contained in the Report represents design criteria, recommendations, and guidelines that were utilized as the basis of design for the engineering of the earthwork operations, paving design, and foundation design indicated in the Contract Documents. No changes in these design criteria will be considered or permitted.

1.4 RESPONSIBILITY
A. Bidders are expected to examine the site and subsurface investigation reports.
B. The Design Professional and Owner assume no responsibility for variations in subsoil conditions, quality, or stability, or for the presence, level, and extent of underground water.
C. The Design Professional and Owner assume no responsibility for Bidder’s interpretation of data contained in the Report.

END OF DOCUMENT
GEOTECHNICAL INVESTIGATION

DINING HALL
UNIVERSITY OF NORTH TEXAS
DENTON, TEXAS

PROJECT NO. 04.40171085

Report to:

UNT SYSTEM
FORT WORTH, TEXAS

APRIL 18, 2018
GEOTECHNICAL INVESTIGATION

DINING HALL
UNIVERSITY OF NORTH TEXAS
DENTON, TEXAS

PROJECT NO. 04.40171085

Report to:

UNT SYSTEM
FORT WORTH, TEXAS

APRIL 18, 2018
FUGRO USA LAND, INC.
2880 Virgo Lane
Dallas, Texas 75229
T +1 972 484 8301
F +1 972 620 7328

Project No. 04.40171085
April 18, 2018

UNT System
Facilities Planning and Construction
1155 Union Circle, Suite 311040
Denton, Texas 76203

Attention: Mr. Andrew Herrell, AIA, LEED GA
Project Manager

GEOTECHNICAL INVESTIGATION
DINING HALL
UNIVERSITY OF NORTH TEXAS
DENTON, TEXAS

Dear Mr. Herrell:

This report presents the results of a geotechnical investigation performed for the referenced project in Denton, Texas. This study was performed in accordance with our Proposal No. 04.40171085, dated January 16, 2018.

Results of field exploration, laboratory testing, engineering analyses as well as our recommendations are included in this report.

We appreciate the opportunity to be of assistance on this project. Please feel free to contact us if you have any questions or if we can be of further service.

Sincerely,

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Che-Hung (Chris) Tsai, Ph.D., P.E.
Senior Project Manager

Sequ I. Ifham, P.E.
Geotechnical Engineering Manager

4-18-18

A member firm of the leading companies with offices throughout the world
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LEED Site Assessment Test Results (by Xenco Laboratories)
INTRODUCTION

This report presents the results of a geotechnical investigation performed for the referenced project in Denton, Texas.

Site and Project Description

The project site is located on the southwest corner of W. Highland Street and Avenue A at the University of North Texas (UNT) campus in Denton, Texas (Approximate GPS Coordinates: 33.2086 N, 97.1466 W). The site currently is a landscape gardening. The general location of the site is shown on Plate 1, Vicinity Map.

We understand that the project will consist of the design and construction of a two-story dining hall with basement, retaining walls, parking lots and drives. The footprint area of the building will be less than 25,000 square feet. The maximum column load of the building will be 250 kips.

Scope of Work

The purpose of this study is to evaluate the subsurface conditions encountered in the borings at selected locations and to develop geotechnical recommendations for the proposed project. This report addresses and provides geotechnical recommendations for:

1. Soil swell potential;
2. Foundation types and design parameters;
3. Floor slabs;
4. IBC seismic site class;
5. Below grade wall/retaining wall;
6. Pavement sections; and
7. Earthwork.
FIELD INVESTIGATION

Four borings were planned for this geotechnical study. However, only two borings were advanced to a depth of 40 feet below the existing grade. Due to the presence of underground utility lines, the remaining borings were not drilled. We recommend that at least one of these two borings be drilled to verify the subsurface soil and rock profile prior to construction. The latitude and longitude of the boring locations were measured using a handheld GPS unit. The approximate locations of the borings are shown on Plate 2, Site and Boring Plan.

The borings were advanced using a truck-mounted drilling rig. Cohesive soil samples were obtained using 3-inch diameter tube samplers that were pushed into the soil. The consistency of cohesive soils was estimated in the field using a calibrated pocket penetrometer.

Granular soil sample and hard material were obtained with a 2-inch O.D. split-spoon sampler. The sampler is typically driven in three 6-inch intervals. The number of blows required for the last 12 inches of penetration or the penetration obtained from 50 blows of the hammer, whichever occurs first, is reported as the “N-value” on the boring logs. The bedrock was evaluated in situ using Texas Department of Transportation cone penetration tests.

Samples were extruded from the samplers in the field, visually classified, and sealed in plastic bags to prevent the loss of moisture or disturbance during their transfer to the laboratory. Upon completion of the field investigation, the borings were backfilled with soil cuttings.

Logs of the borings drilled for this study with descriptions of the subsurface materials encountered are presented on Plates 3 to 4. A key to the terms and symbols used on the boring logs is presented on Plates 5 and 6.

LABORATORY TESTING

Laboratory tests were performed to help evaluate the engineering properties of the soils. The testing program included visual classification, moisture content, dry unit weight, Atterberg limits, passing No. 200 sieve, overburden swell, and unconfined compressive strength of soils. These tests were performed in general accordance with applicable ASTM test procedures. In addition, overburden swell, sulfate, soil electrical resistivity, and a set of LEED site assessment tests
were performed on selected samples. Further, soil permeability tests are being performed. The LEED site assessment tests includes density, organic matter content, pH, Salinity, Cation Exchange Capacity, Total Organic Carbon, Total Nitrogen, Lead, Copper, Cadmium, Chromium, Zinc, Arsenic, Pentachlorophenol-PCP and Creosote. The results of the permeability tests will be provided as soon as the results become available.

The soils were classified according to the Unified Soil Classification System based on visual observation of the samples and laboratory test results. The results of dry density, moisture content, liquid limit, plastic limit, plasticity index, passing No. 200 sieve, and unconfined compressive strength tests are presented on the boring logs. The results of the LEED site assessment tests are attached in the “ILLUSTRATIONS” section of this report. Overburden swell, pH, and resistivity test results are presented in the following tables.

### TABLE 1: SWELL TEST RESULTS

<table>
<thead>
<tr>
<th>Boring Number</th>
<th>Sample Depth (ft.)</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Initial Moisture Content</th>
<th>Final Moisture Content</th>
<th>Surcharge Pressure (psf)</th>
<th>Percent Vertical Swell</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>2-4</td>
<td>55</td>
<td>36</td>
<td>18</td>
<td>27</td>
<td>250</td>
<td>9.1</td>
</tr>
<tr>
<td>B-4</td>
<td>6-7</td>
<td>58</td>
<td>38</td>
<td>25</td>
<td>27</td>
<td>750</td>
<td>2.2</td>
</tr>
</tbody>
</table>

### TABLE 2: SOIL RESISTIVITY AND pH TESTING RESULTS

<table>
<thead>
<tr>
<th>Boring Number</th>
<th>Sample Depth (ft.)</th>
<th>pH</th>
<th>Resistivity (ohms-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>14-15</td>
<td>7.8</td>
<td>382</td>
</tr>
<tr>
<td>B-4</td>
<td>4-6</td>
<td>7.9</td>
<td>429</td>
</tr>
</tbody>
</table>

### GENERAL SUBSURFACE CONDITIONS

**Geology**

Review of surface geology maps indicates the site is located within the geologic Woodbine formation. The formation generally consists of clays and sandy soils underlain by gray shale (or marl). The clay soils of this formation can exhibit high shrink/swell potential with variations in moisture content in the active zone.
Stratigraphy

Based on our interpretation of the borings drilled for this study, the subsurface stratigraphy generally consists of fill and clays underlain by gray shale. The depths to gray shale at each boring location is summarized below.

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Boring Depth (ft.)</th>
<th>Depth to Gray Shale (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>40</td>
<td>23</td>
</tr>
<tr>
<td>B-4</td>
<td>40</td>
<td>24</td>
</tr>
</tbody>
</table>

The subsurface materials encountered in each of the boring are described in the boring logs. The stratification boundaries shown on the boring logs represent the approximate locations of the changes in the soil and rock types; in situ, the transition between material types may be gradual and indistinct.

Groundwater

The borings were drilled using dry auger procedures to observe the depths of groundwater seepage at the time of the exploration. Groundwater seepage was not encountered in borings during the time of the drilling.

It is not possible to accurately predict the magnitude of subsurface water fluctuations that might occur based upon short-term observations. The groundwater levels depend on permeability, rainfall conditions, and other factors. Future construction activities may also alter the surface and subsurface drainage characteristics of the site. If a noticeable change in the conditions is observed during construction, then we should be notified immediately to review its effect on the design recommendations.

ENGINEERING ANALYSIS AND RECOMMENDATIONS

Based on the subsurface conditions encountered in the borings, the proposed structures will be subjected to some movement due to volume changes of the underlying soils. Expansive soils can subject shallow foundations and floor slabs to significant differential movements due to
moisture induced vertical movements of soils. Straight drilled shafts bearing in the gray shale are recommended for supporting foundation loads of the proposed building.

A structurally suspended floor slab system in conjunction with drilled shafts is recommended for the floor slab. With the risk of experiencing some soil-related movements, a ground supported floor slab can be considered as an alternate method. For this alternative approach, the subgrade soils must be improved beneath the floor slab to limit soil-related movements to within tolerable levels.

Flatwork adjacent to the building should be supported on moisture conditioned subgrade. Geotechnical recommendations for foundations, floor slabs, retaining wall, below-grade wall, earthwork and pavement are presented in the following report sections.

**Expansive Soils**

Expansive clays were encountered in the borings. Overburden swell tests performed on selected clay samples indicated a potential swell of 2.2 to 9.1 percent when permitted free access to water at current moisture conditions and under the approximate existing overburden pressure.

The magnitude of moisture-induced vertical movement calculated using TxDOT Method Tex-124-E in conjunction with overburden swell tests is estimated to be on the order of 5 to 6 inches for the dry soil conditions. It should be noted that TxDOT method of calculating PVR is empirical and is based on the results of the Atterberg limits and moisture content of the soils. Swell tests provide data based on the existing moisture profile of the subsurface soils at the time the borings were advanced. The total swell potential depends on the moisture content of the expansive soils within the zone of moisture changes. The drier the expansive soil, the higher the swell potential. Considerably more movement will occur in areas where water ponding is allowed to occur during or after construction.

**Site Seismic Classification**

Based on the results of the field and laboratory tests conducted for this investigation, review of the available geologic mapping, and site class definitions shown in 2012/2015 International Building Code (IBC and ASCE/SEI 7-10), it is our opinion that the subject site be classified as Site Class
C with a soil profile name of “Very Dense Soil and Soft Rock.” We also recommend a design spectral acceleration of 0.089 g for short period (\(S_{OS}\)) and 0.062 g for 1 second period (\(S_{D1}\)).

**Foundation Systems**

We recommend that the proposed building be supported by cast-in-place concrete straight-drilled shafts bearing in gray shale. Design parameters and recommendations for straight drilled shafts are discussed in the following sections.

**Straight Drilled Shaft: Axial Load Design.** The axial capacity of straight drilled shafts will be derived from a combination of end bearing and skin friction. The recommended design parameters are tabulated below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing stratum</td>
<td>Gray shale</td>
</tr>
<tr>
<td>Minimum penetration into bearing stratum to develop end bearing</td>
<td>2 feet into bearing stratum</td>
</tr>
<tr>
<td>Allowable skin friction in compression (^1)</td>
<td>1,200 psf at 2 to 12 feet into bearing stratum</td>
</tr>
<tr>
<td></td>
<td>3,000 psf at more than 10 feet into bearing stratum</td>
</tr>
<tr>
<td>Allowable skin friction in tension (^1,2)</td>
<td>1,000 psf at 2 to 12 feet into bearing stratum</td>
</tr>
<tr>
<td></td>
<td>2,500 psf at more than 10 feet into bearing stratum</td>
</tr>
<tr>
<td>Allowable end bearing capacity</td>
<td>25,000 psf</td>
</tr>
<tr>
<td>Uplift force due to swelling of the clay (^2)</td>
<td>1,800 psf acting over a depth of 10 feet</td>
</tr>
<tr>
<td>Minimum shaft diameter</td>
<td>18 inches</td>
</tr>
<tr>
<td>Reduction in skin friction due to closely located shafts</td>
<td>Center-to-Center Spacing Allowable Skin Friction</td>
</tr>
<tr>
<td></td>
<td>Greater than 3 shaft diameters 100%</td>
</tr>
<tr>
<td></td>
<td>2 to 3 shaft diameters 75%</td>
</tr>
<tr>
<td></td>
<td>Less than 2 shaft diameters 50%</td>
</tr>
<tr>
<td>Settlement (^3)</td>
<td>Less than ¾ inch</td>
</tr>
</tbody>
</table>

**Notes:**

1 - The allowable skin friction should be applied to that portion of the drilled shaft in direct contact with the gray limestone/shale below any temporary casing (if used) and below the minimum penetration length (2 feet).

2 - The allowable skin friction in tension can be utilized to resist the uplift forces in straight drilled shafts. The drilled shafts should be reinforced with sufficient, full-depth, vertical reinforcing steel to resist potential tensile forces.
3 - Settlement will primarily be within the elastic range with a portion of settlement occurring during construction.

**Straight Drilled Shafts: Lateral Load Design.** Based on the subsurface conditions encountered in the borings, parameters for lateral load analysis are provided in the following table for use in LPILE computer program, developed by Ensoft, Inc.

### TABLE 5: LPILE INPUT PARAMETERS FOR SOILS/TAN LIMESTONE

<table>
<thead>
<tr>
<th>Stratum</th>
<th>P-Y Model</th>
<th>Total Unit Weight, $\gamma$ (pcf)</th>
<th>Undrained Cohesion, $C_u$ (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 10 feet below grade</td>
<td>Soft clay</td>
<td>125</td>
<td>500</td>
</tr>
<tr>
<td>Below 10 feet</td>
<td>Stiff clay without free water</td>
<td>125</td>
<td>2,000</td>
</tr>
</tbody>
</table>

### TABLE 6: LPILE INPUT PARAMETERS FOR ROCK BEARING STRATUM

<table>
<thead>
<tr>
<th>Stratum (Gray Shale)</th>
<th>P-Y Model</th>
<th>Total Unit Weight $\gamma$ (pcf)</th>
<th>Uniaxial Compressive Strength $q_u$ (psi)</th>
<th>Initial Modulus of Rock Mass $E_r$ (psi)</th>
<th>Rock Quality Designation RQD (%)</th>
<th>Strain Factor $k_{rm}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 12 feet into rock bearing stratum</td>
<td>Weak Rock</td>
<td>130</td>
<td>100</td>
<td>10,000</td>
<td>70</td>
<td>0.0005</td>
</tr>
<tr>
<td>Below 12 feet in rock bearing stratum</td>
<td>Weak Rock</td>
<td>130</td>
<td>225</td>
<td>45,000</td>
<td>80</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

**Straight Drilled Shafts: Construction Considerations.** The drilled shafts should be installed in accordance with American Concrete Institute’s “Standard Specification for the Construction of Drilled Piers” (ACI 336). The design recommendations provided in this report are based on proper construction procedures, including maintaining a dry shaft excavation and proper cleaning of bearing surfaces prior to placing reinforcing steel and concrete for drilled shaft foundations. The construction of drilled shafts should be observed by experienced geotechnical personnel during construction to help assure compliance with design assumptions. Observations should include:

1. identification of the bearing stratum;
2. minimum penetration depth;
3. removal of all smear zones and cuttings;
4. correct handling of groundwater seepage;
5. shafts are within acceptable vertical tolerance; and
6. other related items.

We recommend that the pier-drilling equipment be equipped with suitable rock drilling teeth and the rig should have sufficient torque and weight to drill through the rock strata. Excavations for the piers must be maintained in a dry condition.

Groundwater was not encountered in borings, but it could be encountered during installation of the drilled shafts, particularly if construction proceeds during a wet period of the year. The seepage rates may require the use of temporary casing for proper installation. The casing must be installed to a sufficient depth to insure that an adequate seal is obtained. Typically, a casing penetration of 1 to 3 feet into the rock bearing material will provide a satisfactory seal.

After the satisfactory installation of the temporary casing, the required penetration into the bearing material may be excavated through the casing. Reinforcing steel and concrete should then be placed immediately after the excavation has been completed, dewatered, cleaned and observed. Dewatering could consist of using a bailing bucket, pumping, mixing the water with dry soil, etc. Water and loose materials in the cased pier excavations should be removed prior to the concrete placement.

A completed shaft excavation should not be allowed to remain open for more than 8 hours. Concrete placed in an excavation in excess of 10 feet should be placed in such a manner (using a tremie, centralizing chute, or by similar means) to prevent segregation of aggregates or to prevent concrete from striking the reinforcing steel. The concrete should have a slump of 6±1 inches.

In the event groundwater is observed during construction, the head of the concrete should be above the static groundwater level prior to breaking the seal between the casing and the bearing stratum. Once the seal is broken, the casing may be slowly removed in a vertical direction (no rotation permitted) while additional concrete is placed through the top of the casing (preferably through a tremie).

During construction of the drilled shafts, care should be taken to avoid creating an oversized cap ("mushroom"), particularly near the ground surface. A "mushroom" at the top of the drilled shaft could be lifted by heave of the expansive soils.
Grade beams and shaft caps. Grade beams and shaft caps should be physically isolated from the underlying soil surface by a void space and be structurally supported by the drilled shaft foundations. A minimum void space of 8 inches should be provided beneath all grade beams and pier caps. The purpose of the void is to provide space for swelling of expansive subsurface materials without resulting in structural distress to the grade beam. Structural cardboard carton forms are often used to provide this void beneath grade beams. Soil retainers (void form skirt) are further recommended to minimize the potential for infilling of the void space over time after carton forms deteriorate.

Cardboard void forms must have sufficient strength to support the weight of the grade beam during construction. Our experience indicates that major distress in grade beams will occur if the integrity of the void box is not maintained during construction. The excavation in which the void box lays must remain dry. Care must be exercised during construction to prevent collapse of these cartons. Backfill material must not be allowed to enter the void carton area below the grade beams, since this reduces the void space in which the underlying soils need to swell.

The exterior grade beams or foundation walls should be backfilled with a well-compacted, on-site clay or clay cover with a minimum thickness of at least 2 feet to retard migration of surface water into the void space. The backfill should be placed and compacted to the specifications presented in “Site Preparation and Fill Construction” section of the report.

Floor Slab Systems

Potential vertical movement at the site is estimated to be about 5 to 6 inches at dry moisture conditions. If floor movements are to be limited to ¾ inch or less, a structural (suspended) floor system is regarded as the most positive approach to limit the potential for post-construction movements. Alternatively, floor slab can also be supported on modified subgrade if movement on the order of one inch is acceptable.

Suspended Floor Slabs. If floor slab movement over ¾ inch cannot be tolerated, we recommend a suspended floor slab system be constructed. Two methods are available for constructing a suspended floor slab system:

1. Cardboard carton forms to create a void; and,
2. Raising the floor slab above the underlying soils with a crawl space.
Carton forms should be at least 8 inches thick. If these forms are used, care must be taken to preserve their structural integrity and ability to create a consistent void. A rigid material layer (such as masonite) should be placed directly on the forms to prevent puncture by personnel during placement of concrete. This rigid layer would also help reduce the potential for concrete to leak down between the cardboard forms. A qualified inspector should be present during floor-slab concrete placement to assure the void is maintained.

If crawl space is utilized, we recommend that the floor slab be suspended at least 12 inches above final subgrade elevations. If utility lines are suspended beneath the slab, the crawl space clearance should be increased to a minimum of 2 feet to provide access to these lines. Future movements of soil supported utility lines must be considered when designing connections, especially where these lines approach or enter the stationary structure. The subgrade beneath the crawl space must be graded to remove water from beneath the structure. If gravity drainage cannot adequately remove the water from beneath the structure, it may be necessary to direct the underfloor drainage ditches to a sump pump. Construction must also contain sufficient ventilation to limit corrosion of the metal components.

Ground-Supported Floor Slabs. If post-construction movement of one inch can be tolerated, consideration may be given to support the floor slabs on improved subgrade. To limit the PVM to one inch, we recommend the subgrade conditions beneath the slab be prepared with one foot of select fill underlain by 10-feet of moisture conditioned soil. Flexible base material (TxDOT, Item 247, Grade 1-2) or crushed concrete may be used instead of select fill, if desired.

We recommend excavation of the soils to a depth of 11 feet below the bottom of floor slab. The excavated clay materials should be mixed with water and placed back in lifts not exceeding 8 inches in loose thickness and compacted to the specification presented for moisture conditioned soils in “Subgrade Preparation and Fill Construction” section of the report. The backfill placement should be stopped at one foot below the bottom of floor slab elevation, and the upper 1 foot should be backfilled with select fill (or flexible base material) and compacted to the criteria presented in “Subgrade Preparation and Fill Construction” section of the report. We recommend that the 1 foot of select fill (or flexible base material) be placed within 24 hours of completing moisture conditioning of subgrade soil.

The ground modification process should be extended at least 5 feet beyond the building lines, building entrances, abutting sidewalks, and flatwork areas sensitive to movement. The select fill or flexible base material is not required outside the building lines.
The Select fill (or flexible base material) should be kept in a moist condition until the floor slab is constructed. This could be achieved by regularly sprinkling water during dry and windy days. We recommend that a vapor barrier of polyethylene sheeting or similar material be placed between the floor slab and the subgrade soils to retard moisture or vapor migration through the slab.

**Below-Grade Floor Slabs.**

We understand that the bottom of the below-grade floor slab will be about 10 feet below the final grade. Based on the subsurface conditions encountered in the borings, the below grade floor slabs will be supported on native fat clays. We recommend the native clay soils below the basement floor should be moisture conditioned to a depth of 5 feet below the basement. A vapor retarder should be provided beneath the slabs that will be carpeted, tiled, or receive moisture sensitive finishes or adhesives.

**Below-Grade Floor Slab Drainage.** A sub-floor drainage system (drainage blanket) is recommended beneath below-grade areas with finished space to prevent hydrostatic uplift pressures and wet spots on the slab.

The drainage blanket should consist of at least 6-inch thick layer of clean crushed stone that meets the requirements of ASTM C-33 No. 56 or 57 Coarse Aggregate. The drainage blanket can be drained by placing drain lines in trenches under the drainage blanket. Sub-floor drain lines should be placed at least 12 inches below the bottom of the slab. This can be accomplished by placing collector drains in shallow trenches. A filter fabric should be used to separate the drainage material from the subgrade soils. Water collected in the perimeter drains and the drain lines under the drainage blanket should be discharged to a sump.

**Flatwork Considerations**

Differential upward movement of all ground-supported slabs should be anticipated and considered during the design of the grading plan. We recommend that all access and entryway slabs and areas of flatwork be constructed on a subgrade prepared in accordance with the recommendations for the building pads, as described in **Ground-Supported Floor Slabs** section. Sidewalks should not be structurally tied to the buildings. To prevent potential tripping hazards, the slabs should be elevated noticeably above the adjacent, relatively non-modified,
ground-supported sidewalks and pavement slabs. Differential upward movement of all ground-supported flatwork should be anticipated and considered during final grading design.

**Below Grade walls**

The proposed buildings will have a single level basement. The height of the basement wall will be about 10 feet tall. We recommend cast-in-place concrete cantilever walls be used to support the cut areas. The walls should be supported on straight shaft drilled piers.

Buildings and paved streets are present adjacent to the proposed construction site. Excavation will require shoring or other means to protect support for the existing structures. Care must be taken not to disturb the foundation system of the adjacent structures or undermine support of the floor slabs and paving.

The following sections discuss about the permanent walls for the basement. Temporary shoring and sloping required for the construction should be addressed by the contractor.

**Backfill Materials.** Basement walls could be either double-formed, single-formed, or a combination of the two. Backfill material will be required for double-formed walls.

Free draining granular materials, select fill, or on-site soils could be considered as backfill for retaining walls. The wall backfill limits should extend outward at least 3 feet from the base of the wall and then upward on a 1H:2V slope. An impervious cover of well-compacted clay should be placed over the free-draining granular backfill and select backfill.

Wall backfill materials should be placed in lifts and uniformly compacted to the specifications presented in “**Subgrade Preparation and Fill Construction**” section of the report. Granular backfill should not be water jetted to achieve compaction and should be placed at a moisture content to allow the desired density to be achieved.

**Lateral Earth Pressure.** The walls are expected to be restrained from lateral movements by the interior floor slabs. For this condition, at-rest earth pressures are recommended for design. Double-formed walls should be designed with a drainage system to prevent hydrostatic pressures from developing. Water proofing should be considered if the interior of the walls is to remain in a dry state.
The magnitude of lateral earth pressure against a double-formed wall is dependent on the type of backfill, method of backfill placement, drainage provisions, ground slope, and the amount of tolerable wall movement. Recommended design lateral earth pressures, expressed as equivalent fluid densities, are presented in the following table.

**TABLE 7: LATERAL EARTH PRESSURES FOR RETAINING WALLS**

<table>
<thead>
<tr>
<th>Backfill Type</th>
<th>Lateral Earth Pressure Coefficient</th>
<th>Equivalent Fluid Pressure Without Hydrostatic Pressures (psf/ft)</th>
<th>Equivalent Fluid Pressure With Hydrostatic Pressures (psf/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free draining granular materials</td>
<td>0.29</td>
<td>36</td>
<td>81</td>
</tr>
<tr>
<td>Select fill</td>
<td>0.39</td>
<td>49</td>
<td>87</td>
</tr>
<tr>
<td>On-site soils (unclassified)</td>
<td>0.53</td>
<td>66</td>
<td>96</td>
</tr>
</tbody>
</table>

The above values assume a soil unit weight of 125 pcf.

Surcharge loads such as vehicular and equipment load should be included in the analysis if they apply at the surface within an area defined by an angle of 45 degrees extending up from the base of the wall.

**Backfill Settlement.** Backfill placed behind the walls should be well compacted. Special care must be exercised to “tie in” the backfill with adjacent undisturbed, firm, natural soils by providing deep benches into the firm natural soil during placement of each fill lift. All loose materials and “slope wash” that may accumulate in the wall excavation during construction should be completely removed prior to placement of the backfill materials.

Some post-construction settlement of the backfill surface should be anticipated. This is typically on the order of 1 to 2 percent of the backfill height, even if satisfactory compaction of the backfill materials is achieved. This will lead to potential differential settlement. Therefore, it is recommended that special consideration be given to the design of any foundation elements, floor slabs, and pavements that may extend over this backfill as a result of the potential for differential settlements introduced by this condition.

**Wall Drainage.** We recommend that positive drainage be provided for the backfill materials so that hydrostatic pressures are not allowed to develop behind the walls, or that the walls be designed to withstand the equivalent fluid pressures with hydrostatic surcharge. The upper
surface of the wall backfill should be sloped to provide for positive drainage away from the structure and minimize the potential for infiltration of surface water into the backfill.

If select fill or on-site soil is chosen as backfill, then a vertical wall drain consisting of a composite geosynthetic drainage medium is recommended for walls with a height greater than 4 feet. The vertical drain should be located immediately behind the wall stem and extend from the level of longitudinal drains, upward to not higher than 2 feet below the top of the wall. The vertical drains should transport water to the longitudinal drains and then to a storm water line. Composite geosynthetic drainage systems are typically proprietary systems. They are available in different sizes and with different flow rates. The manufacturer should be consulted for installation and spacing guidelines.

If free-draining aggregate backfill is used, a vertical wall drain would not be necessary. However, in this case, we recommend that a 2-foot thickness of well-compacted, impervious clay cover be placed over the backfill surface to minimize infiltration in areas that are not covered by pavement. A geotextile filter fabric should be placed between the aggregate backfill and the clay cover materials to minimize infiltration of fines into the backfill, and between the aggregate backfill and the backslope of the native material. The granular backfill should transport water to longitudinal drains and then to a storm water line.

**Temporary Retention System**

The contractor is responsible for maintaining stable and safe excavations in accordance with Occupational Safety and Health Administration (OSHA) standards. Temporary construction slopes should utilize excavation protection systems or be sloped back at an appropriate angle as required by OSHA standards. Excavations deeper than 20 feet will need to be engineered on a case-by-case basis according to OSHA standards.

**Cantilevered Soldier Piers and Lagging.** This system is designed as an anchored bulkhead type of retention system. Cantilevered soldier pile retaining walls can be used to support both cut and fill. A soldier pile wall typically consists of driven or drilled-in H-piles on 6- to 8-foot centers, embedded sufficiently deep below the base of excavation to provide lateral support for the cantilevered portion of the wall that retains the fill or the cut. Facing elements such as timber lagging, shotcrete, or pre-cast concrete panels may be provided to span between soldier piles and transmit the lateral earth pressure loads induced by the retained soil to the soldier piles.
For preliminary design of both soldier pile walls and sheet pile walls, the following parameters can be used.

- Unit weight of soil – 125 pcf
- Angle of internal friction coefficient. – 0.3
- Active pressure coefficient – 0.53
- Passive lateral pressure coefficient – 1.9

Installation of soldier piles penetrating very hard material (weathered bedrock or bedrock) may require pre-drilling. Pre-drilling combined with the potential presence of groundwater could lead to instability of the pre-drilled holes. We recommend the use of temporary casing or slurry if unstable conditions are encountered.

**Soil Nail Wall.** This system utilizes a patterned grid of passive anchors (soil nails), which are installed at a shallow angle from the horizontal as the excavation proceeds downward. Typically, these nails consist of a single length of reinforcing steel approximately 1-inch or larger diameter and on the order of 20 feet in length, similar to a tieback. The soil nails are grouted in place in a small diameter (4 to 6 inches) hole bored into the excavation face. After installing face plates on the nails and draping wire mesh across the face, the exposed section is covered with a thin veneer of shotcrete.

For preliminary design of soil nail walls, the following parameters can be used.

- Ultimate cohesion – about 200 psf
- Ultimate internal soil friction coefficient – 0.3
- Unit weight of soil - 125 pcf
- Ultimate soil-grout bond strength – about 900 psf

**Retaining walls**

We understand that retaining walls may be required for the proposed project. The maximum height of the retaining walls is anticipated to be up to 5 feet tall. Any retaining walls associated with buildings should be supported on straight drilled shafts as discussed in “Foundation Systems” section of this report. Cast-in-place concrete cantilever retaining walls supported on shallow footings can be used for the stand alone retaining walls that are not structurally connected to the building. Shallow footing recommendations for retaining walls are provided below. Other wall recommendations regarding backfill fill material, lateral earth pressure,
backfill settlement, drainage are presented in “Below Grade Walls” section of this report. For retaining walls less than 4 feet in height, weep holes can be used for drainage.

**Shallow Footings – Design Parameters.** The design parameters for shallow continuous footings are provided below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing stratum</td>
<td>On site clay or compacted fill</td>
</tr>
<tr>
<td>Net allowable bearing pressure</td>
<td>1,500 psf</td>
</tr>
<tr>
<td>Minimum embedment</td>
<td>2 feet below lowest adjacent final grade</td>
</tr>
<tr>
<td>Minimum dimension</td>
<td>18 inches</td>
</tr>
<tr>
<td>Passive pressure (triangular distribution)¹,²</td>
<td>237 psf/ ft</td>
</tr>
<tr>
<td>Coefficient of sliding²</td>
<td>0.32</td>
</tr>
</tbody>
</table>

**Notes:**

1. The upper 1-foot of the passive earth pressure should be neglected.
2. A factor of safety of 1.5 is recommended against sliding.

**Shallow Foundations - Construction Considerations.** Excavations for footing should be kept in a moist condition and protected from standing water or desiccation. Loose and soft soils, pieces of rocks, and standing water in the base of the excavation should be cleaned before placing concrete. Complete construction of a section of wall footings, including excavation, placement of steel and concrete, and backfilling should be completed in a reasonably continuous manner, preferably within 48 hours of excavation to reduce drying of the foundation bearing material.

Backfilling of footings should be accomplished using onsite clay and as soon as possible to reduce disturbance of foundation soils. Backfill should be compacted to the criteria presented in “Site Preparation and Fill Construction” section of the report.

Construction of footings should be inspected by a qualified geotechnical engineer to verify the bearing materials and to perform related observations and testing.
Subgrade Preparation and Fill Construction

The project involves excavation of on-site soils and placement and compaction of fill materials.

**Site Preparation.** All the existing structures and features at the site, including pavement sections should be removed. Remnants of any existing or previously demolished structures and foundations should also be removed. Existing underground utility lines should be completely removed or fully grouted to prevent moisture intrusion. Removal of trees should include root bulbs.

**Subgrade Preparation.** The site should be stripped. Prior to placing any new fill in pavement areas, debris and similar unsuitable materials should be removed. After any cutting operations, the exposed subgrade should be proofrolled with a loaded, tandem-axle dump truck weighing a minimum of 25 tons or other heavy, rubber-tired construction vehicle to locate any zones that are soft or unstable. The proofrolling should consist of several overlapping passes in mutually perpendicular directions over a given area. In areas where rutting or pumping occurs during proofrolling, subgrade should be removed and replaced with suitable fill, if it cannot be compacted in place.

**Fill Material Requirements.** Criteria for the selection of different types of fill are summarized below.

<table>
<thead>
<tr>
<th>Fill Type</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site soils</td>
<td>It should be free of rock fragments greater than 4 inches in size, organic matter, and other deleterious materials. Excessive large-sized clay clods based on the judgment of the Geotechnical Engineer should be avoided where possible or conditioned as may be necessary.</td>
</tr>
<tr>
<td>Free draining gravel or sand</td>
<td>Free draining granular materials may include sand, crushed stone, and gravel. The material should have less than 5 percent passing the No. 200 sieve, and less than 40 percent passing the No. 40 sieve. The material passing No. 40 sieve should be non-plastic. ASTM C33 No. 57 or 67, Coarse Aggregate, will meet these requirements.</td>
</tr>
<tr>
<td>Flexible base</td>
<td>This should meet the requirements of TxDOT Item 247 Grade 1-2. Crushed concrete or processed limestone meeting the gradation requirements of flexible base may also be used.</td>
</tr>
<tr>
<td>Select fill</td>
<td>This material should have a liquid limit 35 or less and plasticity index between 5 and 15. The fine content (percent passing a No. 200 sieve) of the material should be between 25 to 55.</td>
</tr>
</tbody>
</table>
**Placement and Compaction Process Controls.** All fill soils should be placed in consistent loose lift thickness. Each lift should be uniformly compacted with the minimum number of passes required for full compaction (i.e. when no further densification is achieved for subsequent compactor passes). Any moisture change must be achieved before compaction.

All completed lifts should be protected or preserved by subsequent lift coverage placed as quickly as practical. Completed lifts damaged by erosion, destructive disturbances during wet conditions, etc. should be scarified and re-compacted. Any lifts or finished fills to be exposed to weathering for a longer period should be covered and protected with sacrificial soil layers or wet matting.

Process control specifications for each fill are provided below.

**TABLE 10: COMPACTION CRITERIA**

<table>
<thead>
<tr>
<th>Fill Type</th>
<th>Requirement¹</th>
<th></th>
<th>Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loose Lift Thickness</td>
<td>Degree of Compaction</td>
<td></td>
</tr>
<tr>
<td>Grade beam/footing/utility line/moisture conditioned/flatwork clay backfill</td>
<td>6 to 8 inches</td>
<td>At least 92% of (\gamma_{\text{dry-max}})</td>
<td>At least 4% points above (m_{\text{opt}})</td>
</tr>
<tr>
<td>Wall backfill ²</td>
<td>6 to 8 inches</td>
<td>At least 95% of (\gamma_{\text{dry-max}})</td>
<td>At or above (m_{\text{opt}})</td>
</tr>
<tr>
<td>Select fill (floor slab)</td>
<td>6 to 8 inches</td>
<td>At least 95% of (\gamma_{\text{dry-max}})</td>
<td>At or above (m_{\text{opt}})</td>
</tr>
<tr>
<td>Flexible base</td>
<td>6 to 8 inches</td>
<td>At least 98% of (\gamma_{\text{dry-max}})</td>
<td>At or above (m_{\text{opt}})</td>
</tr>
<tr>
<td>Pavement subgrade</td>
<td>6 to 8 inches</td>
<td>At least 95% of (\gamma_{\text{dry-max}})</td>
<td>At or above (m_{\text{opt}})</td>
</tr>
<tr>
<td>General site fill</td>
<td>8 to 10 inches</td>
<td>At least 95% of (\gamma_{\text{dry-max}})</td>
<td>At or above (m_{\text{opt}})</td>
</tr>
</tbody>
</table>

**Note:**
1. Maximum dry density (\(\gamma_{\text{dry-max}}\)) and optimum moisture content (\(m_{\text{opt}}\)) should be determined from the results of standard Proctor method (ASTM D 698).
2. Care should be exercised to avoid overstressing the wall by operating heavy compaction equipment too close to the back of the wall. In general, only light compaction equipment, less than 2,000 pounds, should be allowed to operate within 5 feet of the back of the wall.

**Quality Control and Field Testing.** Fill material index properties and compaction control curves required for process control must be obtained upon each change in soil properties, soil color or texture, compactor, or lift thickness, and at minimum frequencies recommended by the
Geotechnical Engineer. For preliminary planning purposes, minimum frequencies of one test per every 1,000 loose cubic yards is recommended. Fill soil sampling should be planned and coordinated to fit the construction production goals, and generally at least two days in advance of the compaction of corresponding fill lifts.

The Geotechnical Engineer should perform moisture-density tests at appropriate frequencies on compacted lifts to ensure that the compaction control specifications are achieved. Field testing volumes and frequencies will depend on confirmation of other process controls and fill soil ranges and variations. Typically for mass fills, one moisture-density test should be performed per every 2,500 square feet of compacted lift or fraction thereof. For trench backfill and small areas of filling, one field moisture content and density testing should be performed for every 200 cubic yards of backfill placed for each lift or per every 200 lineal feet of trench, whichever represents the greater frequency of testing. The Geotechnical Engineer or his representative should determine the acceptability of each compacted lift based on this regime of field moisture content and density testing. Field density gauge probes must be deployed to measure the average properties of the compacted lift.

**Site Grading, Drainage, and Landscaping**

The exterior ground surface around the structure should be sloped at a 5 percent grade for a distance of at least 10 feet to provide for positive surface drainage away from the building. Excess water ponding on and beside slab-on-ground foundations, pavements, sidewalks, or similar structures can cause unacceptable heave of these elements.

Roof drainage should be transmitted by pipe to a storm drainage system or to a paved surface where the water can drain away without entering the foundation soils beneath the building. A system of gutters and downspouts is recommended, with discharge at points at least 5 feet away from the perimeter of the foundation slab.

Excess water ponding on and beside roadways, sidewalks, and slabs can cause unacceptable heave of these elements. To reduce this potential heave, good surface drainage should be established in all building, flatwork, and pavement areas. Lawn irrigation systems should be designed and operated to minimize saturation of soil adjacent to structures. Sprinkler mains should not be placed next to the building.

Backfill for utility lines or along the perimeter grade beams should consist of well-compacted, impermeable, on-site clays to minimize the potential for localized infiltration of surface water.
The soils should be processed and moisture conditioned using the previously discussed compaction criteria. Where the utility lines pass beneath pavements, the top 6 inches should be compacted similarly to the remainder of the subgrade.

Trees will remove water from the soil and, as a result, can cause the soil to shrink. Therefore, trees should either:

1. not be planted closer than the mature tree height from the building (if ground-supported slab is used) or pavement edge; or
2. have a controlled irrigation system; or
3. be planted in containers.

Bedding soils for plants may collect and direct water underneath the building and pavements. Care should be taken to insure that water entering the bedding soils drains away from the building and pavement perimeters. If positive drainage cannot be achieved, the use of an impermeable, synthetic geo-membrane moisture barrier should be considered to reduce the risk of free water migration. An 18-inch deep vertical water barrier along the flatwork edge fronting landscaped areas may be desirable to help prevent irrigation water from having ready access to the soils beneath the flatwork. Special attention should be given to provide good drainage from plantings inside any building courtyards and planter boxes.

The completed landscaping should be carefully inspected to verify that plantings properly drain. Soil in plantings may settle, which will tend to pond water, or plantings may block entrances to surface drains. Therefore, maintaining positive drainage from landscape irrigation will be an ongoing concern.

**Pavement**

**Subgrade Preparation.** We recommend the subgrade soils beneath the be compacted to the specifications presented in “Subgrade Preparation and Fill Construction” section of the report.

**Pavement Sections.** The following Portland cement concrete pavement sections are recommended for this site:
### TABLE 11: PAVEMENT SECTION THICKNESS

<table>
<thead>
<tr>
<th>Pavement Section</th>
<th>Thickness (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portland Cement Concrete Pavement</strong></td>
<td></td>
</tr>
<tr>
<td><em>Light Traffic (Automobile Parking Areas)</em></td>
<td></td>
</tr>
<tr>
<td>TxDOT Item 360, Portland cement concrete</td>
<td>5</td>
</tr>
<tr>
<td>Compacted subgrade</td>
<td>8</td>
</tr>
<tr>
<td><em>Medium Heavy Traffic (Drives)</em></td>
<td></td>
</tr>
<tr>
<td>TxDOT Item 360, Portland cement concrete</td>
<td>6</td>
</tr>
<tr>
<td>Compacted subgrade</td>
<td>8</td>
</tr>
<tr>
<td><em>Heavy Traffic (Dumpsters, Loading Docks, Fire Lanes, and Heavy Traffic Turning)</em></td>
<td></td>
</tr>
<tr>
<td>TxDOT Item 360, Portland cement concrete</td>
<td>7</td>
</tr>
<tr>
<td>Compacted subgrade</td>
<td>8</td>
</tr>
</tbody>
</table>

A sand-leveling course should not be permitted beneath pavements. Design of the concrete pavements should specify a minimum 28-day concrete compressive strength of 3,600 psi. The concrete should be placed within one and one-half hours of batching. During hot weather, the concrete placement should follow ACI 305 Hot Weather concreting. Consideration should be given to limiting concrete placement to the time of day that will minimize large differences in the ambient and concrete temperate. Use of superplasticizer should be considered to improve the concrete workability without increasing water cement ratio. The pavement should be reinforced, at a minimum, using at least No. 3 bars on a grid spacing of 18 inches on center, each way.

The concrete pavements should have adequately-spaced contraction joints to control shrinkage cracking. Past experience indicates that reinforced concrete pavements with sealed contraction joints on 12 to 15-foot spacing, cut to a depth of one-quarter to one-third of the pavement thickness, have generally exhibited less uncontrolled post-construction cracking than pavements with wider spacing. The contraction joint pattern should divide the pavement into panels that are approximately square where the panel length should not exceed 25 percent more than the panel width. Saw cut, post placement formed contraction joints should be saw cut as soon as the concrete can support the saw cutting equipment and personnel and before shrinkage cracks appear, on the order of 4 to 6 hours after concrete placement. Rubberized asphalt, silicone or other suitable flexible sealant could be used to seal the joints. Isolation joints should be used wherever the pavement will abut a structural element subject to a different magnitude of movement, e.g., light poles, retaining walls, existing pavement, stairways, entryway piers, building walls, or manholes.
LIMITATIONS

Since some variation was found in subsurface conditions at the specific boring locations for this study, all readers should be aware that a greater variation could occur between the boring locations. Statements in the report as to subsurface variations across the site are intended only as estimations from the data obtained at specific boring locations.

Additionally, Fugro’s scope of work does not include the investigation, detection, or recommendations related to the presence of any biological pollutants. The term “biological pollutants” includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the by-products of any such biological organisms.

In preparation of this report, we have strived to perform our services in a manner consistent with that level of care and skill ordinarily exercised by other members of our profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report, any addendum report, opinion, document, or other instrument of service.

The results, conclusions, and recommendations contained in this report are directed at, and intended to be utilized within, the scope of work contained in the agreement executed by Fugro and client. This report is not intended for any other purposes. Fugro makes no claim or representation concerning any activity or condition falling outside the specified purposes to which this report is directed, said purposes being specifically limited to the scope of work as defined in our agreement. Inquiries as to our scope of work or concerning any activity or condition not specifically contained therein should be directed to Fugro for evaluation and, if necessary, further investigation.
ILLUSTRATIONS

Boring and laboratory data presented were developed solely for the preparation of this report. We are not responsible for interpretation or use of these data for purposes beyond the stated scope of this report.

Subsurface conditions different than those found at our boring locations may be present because of, among other factors, soil moisture variations, fill placement, and naturally occurring variations in soil properties, and elevation of the top of the rock.
SITE AND BORING PLAN

Legend

- Approximate Boring Location
- Proposed Building Location

Legend

- Approximate Boring Location
- Proposed Building Location

Scale: 1 inch = 84 feet

Source:
Orthophotography: Google Earth Pro, 2017

Drawn By:
DG

Date:
April 12, 2018

Project No.:
04.40171085

PLATE 2
<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>STRATUM DESCRIPTION</th>
<th>LAYER ELEV./ DEPTH</th>
<th>WATER CONTENT, %</th>
<th>LIQUID LIMIT, %</th>
<th>PLASTIC LIMIT, %</th>
<th>PLASTICITY INDEX (PI), %</th>
<th>PASSING NO. 200 SIEVE, %</th>
<th>DENSITY, LC</th>
<th>DENSITY, IP</th>
<th>COMPRESSION STRENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>P = 4.0</td>
<td>FILL, CLAY, dark brown and reddish brown, very stiff, with gravels</td>
<td>31</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>P = 4.5</td>
<td>FAT CLAY (CH), light brown and brownish gray, hard, with calcareous deposit seams and gravels</td>
<td>18 55 19 36 117</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>15</td>
<td>P = 4.5</td>
<td>FAT CLAY (CH), brownish gray, hard, shaley, with calcareous deposit seams</td>
<td>8.0</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>42/12&quot;</td>
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<tr>
<td>20</td>
<td>P = 4.5+</td>
<td></td>
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<tr>
<td>25</td>
<td>P = 4.5+</td>
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<tr>
<td>30</td>
<td>P = 4.5+</td>
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<td>40</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>SHALE, gray</td>
<td>P = 4.5+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: All depths are measured in feet.

KEY:
P = Pocket Penetrometer
N = Standard Penetration Resistance

WATER LEVEL (UPON COMPLETION): DRY
DATE DRILLED: 4-9-18
WATER LEVEL / SEEPAGE: DRY
COMPLETION DEPTH: 40.0
PROJECT NO. 04.40171085
Dining Hall
University of North Texas
Denton, Texas
PLATE 3a
LOG OF BORING NO. B-1
Dining Hall
University of North Texas
Denton, Texas
PROJECT NO. 04.40171085

LATITUDE: 33.20876
LONGITUDE: -97.14678

STRATUM DESCRIPTION

DATE DRILLED: 4-9-18
SURF. ELEVATION: Unknown

SHALE, gray (continued)

LIQUID LIMIT, %
WATER CONTENT, %
DATE...
### LOG OF BORING NO. B-4

**Dining Hall**  
University of North Texas  
Denton, Texas  
PROJECT NO. 04.40171085

<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>STRATUM DESCRIPTION</th>
<th>SCANNED DEPTH</th>
<th>WATER CONTENT, %</th>
<th>LIQUID LIMIT, %</th>
<th>PLASTIC LIMIT, %</th>
<th>PLASTICITY INDEX (PI), %</th>
<th>PASSING NO. 200 SIEVE, %</th>
<th>UNIT DRY WEIGHT, PCF</th>
<th>SOIL FRIABILITY</th>
<th>ROCK (PSI)</th>
<th>SOIL (TSF)</th>
<th>PLATE 4a</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>P = 1.0</td>
<td>FILL, CLAY, dark brown and reddish brown, stiff, with gravel</td>
<td>10.0</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>P = 1.5</td>
<td>FAT CLAY (CH), brownish gray and light brown, stiff to hard</td>
<td></td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>P = 3.5</td>
<td>- calcareous deposits and gravels at 8' to 10'</td>
<td></td>
<td>19</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>8</td>
<td>P = 4.5+</td>
<td>N = 37</td>
<td></td>
<td>25</td>
<td>58</td>
<td>20</td>
<td>38</td>
<td>93</td>
<td>98</td>
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<td>9</td>
<td>P = 4.5+</td>
<td>FAT CLAY (CH), brownish gray, hard, shaley</td>
<td>10.0</td>
<td>14</td>
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<tr>
<td>10</td>
<td>P = 4.5+</td>
<td>- with calcareous deposits and gravel, at 14'</td>
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<tr>
<td>11</td>
<td>P = 4.5+</td>
<td>SHALE, gray</td>
<td>24.0</td>
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<td>115</td>
<td>4.8</td>
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</tr>
</tbody>
</table>

**COMPLETION DEPTH:** 40.0  
**DATE DRILLED:** 4-9-18  
**WATER LEVEL / SEEPAGE:** DRY  
**WATER LEVEL (UPON COMPLETION):** DRY  

**KEY:**  
P = Pocket Penetrometer  
N = Standard Penetration Resistance  
Note: All depths are measured in feet.
<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>SAMPLES</th>
<th>POCKET PEN</th>
<th>BORE HOLE</th>
<th>RECORD, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>35</td>
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</tr>
<tr>
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</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**STRATUM DESCRIPTION**

- **SURF. ELEVATION:** Unknown

- **SHALE, gray (continued)**

**DATE DRILLED:** 4-9-18

**COMPLETION DEPTH:** 40.0

**WATER LEVEL (UPON COMPLETION):** DRY

**PLATE 4b**
Note: Information on each boring log is a compilation of subsurface conditions and soil and rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

References:
Note: Information on each boring log is a compilation of subsurface conditions and soil and rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

Analytical Report  581927
for
Fugro Consultants Inc. - Dallas

Project Manager: Chris Tsai
Dining Hall
04-40171085
18-APR-18

Collected By: Client

9701 Harry Hines Blvd
Dallas, TX 75220

Xenco-Houston (EPA Lab Code: TX00122):
Texas (T104704215-18-24), Arizona (AZ0765), Florida (E871002-24), Louisiana (03054)
Oklahoma (2017-142)

Xenco-Dallas (EPA Lab Code: TX01468):
Texas (T104704295-17-16), Arizona (AZ0809), Arkansas (17-063-0)

Xenco-El Paso (EPA Lab Code: TX00127):
Texas (T104704221-17-12)

Xenco-Lubbock (EPA Lab Code: TX00139):
Texas (T104704219-17-16)

Xenco-Odessa (EPA Lab Code: TX00158):
Texas (T104704400-18-14)

Xenco-San Antonio (EPA Lab Code: TNI02385):
Texas (T104704534-17-3)

Xenco Phoenix (EPA Lab Code: AZ00901):
Arizona (AZ0757)

Xenco-Phoenix Mobile (EPA Lab Code: AZ00901):
Arizona (AZM757)

Xenco-Atlanta (LELAP Lab ID #04176)
Xenco-Tampa: Florida (E87429)
Xenco-Lakeland: Florida (E84098)
Chris Tsai:

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 581927. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 581927 will be filed for 45 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Wendy Walfoort
Project Manager

Recipient of the Prestigious Small Business Administration Award of Excellence in 1994.
Certified and approved by numerous States and Agencies.
A Small Business and Minority Status Company that delivers SERVICE and QUALITY

Houston - Dallas - Midland - San Antonio - Phoenix - Oklahoma - Latin America
### Sample Cross Reference 581927

**Fugro Consultants Inc. - Dallas, Dallas, TX**

**Dining Hall**

<table>
<thead>
<tr>
<th>Sample Id</th>
<th>Matrix</th>
<th>Date Collected</th>
<th>Sample Depth</th>
<th>Lab Sample Id</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1 14'-15'</td>
<td>S</td>
<td>04-09-18 13:50</td>
<td>14 - 15 ft</td>
<td>581927-001</td>
</tr>
<tr>
<td>B-4 4'-6'</td>
<td>S</td>
<td>04-09-18 15:30</td>
<td>4 - 6 ft</td>
<td>581927-002</td>
</tr>
</tbody>
</table>
CASE NARRATIVE

Client Name: Fugro Consultants Inc. - Dallas
Project Name: Dining Hall

Project ID: 04-40171085
Work Order Number(s): 581927
Report Date: 18-APR-18
Date Received: 04/10/2018

Sample receipt non conformances and comments:
None

Sample receipt non conformances and comments per sample:

None

Analytical non conformances and comments:
Batch: LBA-3046597 Total Metals by SW6020A
Samples re digested to confirm the MS/MSD recovery

Batch: LBA-3046670 Nitrogen, Kjeldahl, Total (Colorime by EPA 351.2
Lab Sample ID 581927-001 was randomly selected for Matrix Spike/Matrix Spike Duplicate (MS/MSD).
Nitrogen, Total Kjeldahl recovered below QC limits in the Matrix Spike and Matrix Spike Duplicate.
Outlier/s are due to possible matrix interference. Samples in the analytical batch are: 581927-001, -002.
The Laboratory Control Sample for Nitrogen, Total Kjeldahl is within laboratory Control Limits,
therefore the data was accepted.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Nitrate-Nitrite (as N)</td>
<td>7727-37-9</td>
<td>2.10</td>
<td>0.992</td>
<td>mg/kg</td>
<td>04.16.18 10.22</td>
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<tr>
<td>Organic Matter Reduction</td>
<td>4.41</td>
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<td></td>
<td>%</td>
<td>04.17.18 12.00</td>
<td>K</td>
<td>1</td>
</tr>
<tr>
<td>Total Nitrogen (calculated)</td>
<td>7727-37-9</td>
<td>257.6</td>
<td>1.000</td>
<td>mg/kg</td>
<td>04.18.18 11.38</td>
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<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>7440-38-2</td>
<td>9.32</td>
<td>1.79</td>
<td>mg/kg</td>
<td>04.12.18 23.42</td>
<td>10</td>
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</tr>
<tr>
<td>Cadmium</td>
<td>7440-43-9</td>
<td>&lt;1.79</td>
<td>1.79</td>
<td>mg/kg</td>
<td>04.12.18 23.42</td>
<td>U</td>
<td>10</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>13.4</td>
<td>3.57</td>
<td>mg/kg</td>
<td>04.12.18 23.42</td>
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</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>6.68</td>
<td>3.57</td>
<td>mg/kg</td>
<td>04.12.18 23.42</td>
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<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>8.18</td>
<td>1.79</td>
<td>mg/kg</td>
<td>04.12.18 23.42</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>38.1</td>
<td>26.8</td>
<td>mg/kg</td>
<td>04.12.18 23.42</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
Certificate of Analytical Results 581927

Fugro Consultants Inc. - Dallas, Dallas, TX

Dining Hall

Sample Id: B-1 14'-15'
Lab Sample Id: 581927-001

Date Received: 04.10.18 15.50
Date Collected: 04.09.18 13.50
Sample Depth: 14 - 15 ft

Analytical Method: Cation-Exchange Capacity of Soils (Sodium Acetate)
Tech: DEP
Analyst: DEP
Seq Number: 3046957

<table>
<thead>
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<th>Parameter</th>
<th>Cas Number</th>
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<th>Dil</th>
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</thead>
<tbody>
<tr>
<td>Cation-Exchange Capacity</td>
<td>286</td>
<td>0.100</td>
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<td>meq/100g</td>
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</tbody>
</table>

Analytical Method: Nitrogen, Kjeldahl, Total (Colorime by EPA 351.2)
Tech: KCS
Analyst: KCS
Seq Number: 3046670

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<thead>
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<th>Parameter</th>
<th>Cas Number</th>
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<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Total Kjeldahl</td>
<td>7727-37-9</td>
<td>255</td>
<td>38.5</td>
<td>mg/kg</td>
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</table>

Analytical Method: Nitrogen, Nitrate-Nitrite by EPA 353.2
Tech: KCS
Analyst: KCS
Seq Number: 3047014

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Nitrate-Nitrite</td>
<td>7727-37-9</td>
<td>1.03</td>
<td>0.998</td>
<td>mg/kg</td>
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Analytical Method: Specific Conductance by SW-846 9050A
Tech: MJP
Analyst: MJP
Seq Number: 3046764

<table>
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<tr>
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<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>COND</td>
<td>1340</td>
<td>2.00</td>
<td>uS/cm</td>
<td>04.16.18 11.30</td>
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</tbody>
</table>
Certificate of Analytical Results 581927

Fugro Consultants Inc. - Dallas, Dallas, TX
Dining Hall

Sample Id: B-1 14'-15'
Lab Sample Id: 581927-001

Analytical Method: Sulfate by SW-846 9038
Tech: SDK
Analyst: SDK
Seq Number: 3046439

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate</td>
<td>14808-79-8</td>
<td>223</td>
<td>49.3</td>
<td>mg/kg</td>
<td>04.12.18 09.50</td>
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Analytical Method: TOC in Soils by Walkley Black
Tech: DHE
Analyst: DHE
Seq Number: 3046912

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Organic Carbon</td>
<td>7440-44-0</td>
<td>&lt;0.500</td>
<td>500</td>
<td>mg/kg</td>
<td>04.17.18 14.00</td>
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Analytical Method: SVOAs by EPA 8270C
Tech: DRU
Analyst: EKL
Seq Number: 3046586

<table>
<thead>
<tr>
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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-methylphenol</td>
<td>95-48-7</td>
<td>&lt;0.167</td>
<td>0.167</td>
<td>mg/kg</td>
<td>04.12.18 18.38</td>
<td>U</td>
<td>1</td>
</tr>
<tr>
<td>3&amp;4-Methylphenol</td>
<td>15831-10-4</td>
<td>&lt;0.167</td>
<td>0.167</td>
<td>mg/kg</td>
<td>04.12.18 18.38</td>
<td>U</td>
<td>1</td>
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<tr>
<td>Pentachlorophenol</td>
<td>87-86-5</td>
<td>&lt;0.333</td>
<td>0.333</td>
<td>mg/kg</td>
<td>04.12.18 18.38</td>
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Surrogate

<table>
<thead>
<tr>
<th>Surrogate</th>
<th>Cas Number</th>
<th>% Recovery</th>
<th>Units</th>
<th>Limits</th>
<th>Analysis Date</th>
<th>Flag</th>
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<tbody>
<tr>
<td>2-Fluorobiphenyl</td>
<td>321-60-8</td>
<td>73</td>
<td>%</td>
<td>30-115</td>
<td>04.12.18 18.38</td>
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<tr>
<td>2,4,6-Tribromophenol</td>
<td>118-79-6</td>
<td>84</td>
<td>%</td>
<td>19-122</td>
<td>04.12.18 18.38</td>
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<tr>
<td>Terphenyl-D14</td>
<td>1718-51-0</td>
<td>90</td>
<td>%</td>
<td>18-137</td>
<td>04.12.18 18.38</td>
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</tr>
</tbody>
</table>
**Certificate of Analytical Results 581927**

**Fugro Consultants Inc. - Dallas, Dallas, TX**

**Dining Hall**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Nitrate-Nitrite (as N)</td>
<td>7727-37-9</td>
<td>2.15</td>
<td>1.00</td>
<td>mg/kg</td>
<td>04.16.18 10.32</td>
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</table>

**Analytical Method:** Inorganic Anions by SW 9056

**Tech:** MAB

**Analytical Method:** Organic Matter in Soil by ASTM D2974

**Tech:** YAV

<table>
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<tr>
<th>Parameter</th>
<th>Cas Number</th>
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<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
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<tbody>
<tr>
<td>Organic Matter Reduction</td>
<td>2.23</td>
<td>%</td>
<td>04.17.18 12.00</td>
<td>K</td>
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**Analytical Method:** Total Nitrogen

**Tech:** MAB

<table>
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<th>Parameter</th>
<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (calculated)</td>
<td>7727-37-9</td>
<td>231.6</td>
<td>1.00</td>
<td>mg/kg</td>
<td>04.18.18 11.38</td>
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**Analytical Method:** Total Metals by SW6020A

**Tech:** PJB

<table>
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<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
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</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>7440-38-2</td>
<td>4.61</td>
<td>1.69</td>
<td>mg/kg</td>
<td>04.12.18 23.45</td>
<td>10</td>
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</tr>
<tr>
<td>Cadmium</td>
<td>7440-43-9</td>
<td>&lt;1.69</td>
<td>1.69</td>
<td>mg/kg</td>
<td>04.12.18 23.45</td>
<td>U</td>
<td>10</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>10.8</td>
<td>3.39</td>
<td>mg/kg</td>
<td>04.12.18 23.45</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>6.27</td>
<td>3.39</td>
<td>mg/kg</td>
<td>04.12.18 23.45</td>
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<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>5.93</td>
<td>1.69</td>
<td>mg/kg</td>
<td>04.12.18 23.45</td>
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<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>&lt;25.4</td>
<td>25.4</td>
<td>mg/kg</td>
<td>04.12.18 23.45</td>
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</table>
### Cation-Exchange Capacity +

<table>
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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cation-Exchange Capacity</td>
<td>223</td>
<td>0.100</td>
<td></td>
<td>meq/100g</td>
<td>04.17.18 18.14</td>
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### Nitrogen, Total Kjeldahl

<table>
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<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
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</thead>
<tbody>
<tr>
<td>Nitrogen, Total Kjeldahl</td>
<td>7727-37-9</td>
<td>229</td>
<td>39.2</td>
<td>mg/kg</td>
<td>04.13.18 16.46</td>
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### Nitrogen, Nitrate-Nitrite by EPA 353.2

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<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Nitrate-Nitrite</td>
<td>7727-37-9</td>
<td>1.17</td>
<td>0.998</td>
<td>mg/kg</td>
<td>04.18.18 10.34</td>
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### Specific Conductance by SW-846 9050A

<table>
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<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
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</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>COND</td>
<td>878</td>
<td>2.00</td>
<td>uS/cm</td>
<td>04.16.18 11.30</td>
<td>1</td>
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</table>
### Certificate of Analytical Results 581927

**Fugro Consultants Inc. - Dallas, Dallas, TX**

**Dining Hall**

- **Sample Id:** B-4 4'-6'
- **Matrix:** Soil
- **Date Received:** 04.10.18 15.50
- **Date Collected:** 04.09.18 15.30
- **Sample Depth:** 4 - 6 ft

**Analytical Method:** Sulfate by SW-846 9038

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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
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</thead>
<tbody>
<tr>
<td>Sulfate</td>
<td>14808-79-8</td>
<td>385</td>
<td>49.2</td>
<td>mg/kg</td>
<td>04.12.18 09.50</td>
<td>U</td>
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**Analytical Method:** TOC in Soils by Walkley Black

<table>
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<tr>
<th>Parameter</th>
<th>Cas Number</th>
<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Organic Carbon</td>
<td>7440-44-0</td>
<td>&lt;0.500</td>
<td>0.500</td>
<td>mg/kg</td>
<td>04.17.18 14.00</td>
<td>U</td>
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**Analytical Method:** SVOAs by EPA 8270C

<table>
<thead>
<tr>
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<th>Result</th>
<th>RL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-methylphenol</td>
<td>95-48-7</td>
<td>&lt;0.166</td>
<td>0.166</td>
<td>mg/kg</td>
<td>04.12.18 18.58</td>
<td>U</td>
<td>1</td>
</tr>
<tr>
<td>3&amp;4-Methylphenol</td>
<td>15831-10-4</td>
<td>&lt;0.166</td>
<td>0.166</td>
<td>mg/kg</td>
<td>04.12.18 18.58</td>
<td>U</td>
<td>1</td>
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<tr>
<td>Pentachlorophenol</td>
<td>87-86-5</td>
<td>&lt;0.333</td>
<td>0.333</td>
<td>mg/kg</td>
<td>04.12.18 18.58</td>
<td>U</td>
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</table>

**Prep Method:** SW3550

- **% Moisture:**
- **Basis:** Wet Weight

**Surrogate**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cas Number</th>
<th>% Recovery</th>
<th>Units</th>
<th>Limits</th>
<th>Analysis Date</th>
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<tbody>
<tr>
<td>2-Fluorophenol</td>
<td>367-12-4</td>
<td>72</td>
<td>%</td>
<td>25-121</td>
<td>04.12.18 18.58</td>
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<tr>
<td>Phenol-d6</td>
<td>13127-88-3</td>
<td>73</td>
<td>%</td>
<td>24-113</td>
<td>04.12.18 18.58</td>
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<tr>
<td>Nitrobenzene-d5</td>
<td>4165-60-0</td>
<td>75</td>
<td>%</td>
<td>23-120</td>
<td>04.12.18 18.58</td>
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<tr>
<td>2-Fluorobiphenyl</td>
<td>321-60-8</td>
<td>80</td>
<td>%</td>
<td>30-115</td>
<td>04.12.18 18.58</td>
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<tr>
<td>2,4,6-Tribromophenol</td>
<td>118-79-6</td>
<td>87</td>
<td>%</td>
<td>19-122</td>
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<td>Terphenyl-D14</td>
<td>1718-51-0</td>
<td>78</td>
<td>%</td>
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Blank Summary

Fugro Consultants Inc. - Dallas, Dallas, TX
Dining Hall

Sample Id: 3046439-1-BLK  
Lab Sample Id: 3046439-1-BLK  
Matrix: SOLID

Analytical Method: Sulfate by SW-846 9038  
Prep Method:

Tech: SDK  
Analyst: SDK  
Date Prep: 
Seq Number: 3046439

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<th>Units</th>
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<th>Flag</th>
<th>Dil</th>
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<tr>
<td>Sulfate</td>
<td>14808-79-8</td>
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<td>04.12.18 09:50</td>
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**Fugro Consultants Inc. - Dallas, Dallas, TX**

**Dining Hall**

### Analytical Method

- **Sample Id:** 3046764-1-BLK
- **Lab Sample Id:** 3046764-1-BLK
- **Matrix:** SOLID

**Analytical Method:** Specific Conductance by SW-846 9050A

**Prep Method:**

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<td>Conductivity</td>
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<td>&lt;2.00</td>
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<td>uS/cm</td>
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Fugro Consultants Inc. - Dallas, Dallas, TX
Dining Hall

**Sample Id:** 3046912-1-BLK  
**Lab Sample Id:** 3046912-1-BLK

**Analytical Method:** TOC in Soils by Walkley Black  
**Prep Method:**

**Tech:** DHE  
**Analyst:** DHE  
**Seq Number:** 3046912

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<th>Flag</th>
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</thead>
<tbody>
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<td>Total Organic Carbon</td>
<td>7440-44-0</td>
<td>&lt;0.500</td>
<td>0.500</td>
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<td>mg/kg</td>
<td>04.17.18 14:00</td>
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Sample Id: 3046928-1-BLK  
Lab Sample Id: 3046928-1-BLK  

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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
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<tbody>
<tr>
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<td></td>
<td>0.0800</td>
<td></td>
<td></td>
<td>%</td>
<td>04.17.18 12:00</td>
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Analytical Method: Organic Matter in Soil by ASTM D2974  
Tech: YAV  
Analyst: YAV  
Seq Number: 3046928  

Prep Method:  
Date Prep: SUB: TX104704215-18-24
Sample Id: 7642383-1-BLK
Lab Sample Id: 7642383-1-BLK

Analytical Method: SVOAs by EPA 8270C
Tech: DRU
Analyst: EKL
Seq Number: 3046586

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<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
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<td>2-methylphenol</td>
<td>95-48-7</td>
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<td>mg/kg</td>
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<td>U</td>
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<tr>
<td>3&amp;4-Methylphenol</td>
<td>15831-10-4</td>
<td>&lt;0.167</td>
<td>0.167</td>
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<td>mg/kg</td>
<td>04.11.18 21:27</td>
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<td>Pentachlorophenol</td>
<td>87-86-5</td>
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<td>mg/kg</td>
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**Fugro Consultants Inc. - Dallas, Dallas, TX**

**Dining Hall**

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<th>Units</th>
<th>Analysis Date</th>
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<tbody>
<tr>
<td>Arsenic</td>
<td>7440-38-2</td>
<td>&lt;0.200</td>
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<td></td>
<td>mg/kg</td>
<td>04.12.18 22:53</td>
<td>U</td>
<td>1</td>
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<tr>
<td>Cadmium</td>
<td>7440-43-9</td>
<td>&lt;0.200</td>
<td>0.200</td>
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<td>mg/kg</td>
<td>04.12.18 22:53</td>
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<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>&lt;0.400</td>
<td>0.400</td>
<td></td>
<td>mg/kg</td>
<td>04.12.18 22:53</td>
<td>U</td>
<td>1</td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>&lt;0.400</td>
<td>0.400</td>
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<td>mg/kg</td>
<td>04.12.18 22:53</td>
<td>U</td>
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</tr>
<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>&lt;0.200</td>
<td>0.200</td>
<td></td>
<td>mg/kg</td>
<td>04.12.18 22:53</td>
<td>U</td>
<td>1</td>
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<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>&lt;3.00</td>
<td>3.00</td>
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<td>mg/kg</td>
<td>04.12.18 22:53</td>
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Blank Summary 581927

Fugro Consultants Inc. - Dallas, Dallas, TX
Dining Hall

Sample Id: 7642647-1-BLK  
Lab Sample Id: 7642647-1-BLK  
Matrix: SOLID

Analytical Method: Nitrogen, Kjeldahl, Total (Colorime by EPA 351.2)  
Prep Method: E351.2P
Tech: KCS  
Analyst: KCS  
Seq Number: 3046670  
Date Prep: 04.12.18 17:17  
SUB: TX104704215-18-24

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<th>Result</th>
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<th>MDL</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
<th>Dil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Total Kjeldahl</td>
<td>7727-37-9</td>
<td>&lt;40.0</td>
<td>40.0</td>
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**Sample Id:** 7642711-1-BLK  
**Lab Sample Id:** 7642711-1-BLK  
**Matrix:** SOLID  

**Analytical Method:** Total Metals by SW6020A  
**Prep Method:** SW3050B  
**Tech:** PJB  
**Date Prep:** 04.16.18 10:35  
**Date Prep:** 04.16.18 17:06  
**Seq Number:** 3046597  

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<th>Units</th>
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<tbody>
<tr>
<td>Arsenic</td>
<td>7440-38-2</td>
<td>&lt;0.200</td>
<td>0.200</td>
<td>0.200</td>
<td>mg/kg</td>
<td>04.16.18 17:06</td>
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<td>Cadmium</td>
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<td>Chromium</td>
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<td>0.400</td>
<td>0.400</td>
<td>mg/kg</td>
<td>04.16.18 17:06</td>
<td>U</td>
<td>1</td>
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<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>&lt;0.400</td>
<td>0.400</td>
<td>0.400</td>
<td>mg/kg</td>
<td>04.16.18 17:06</td>
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<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>&lt;0.200</td>
<td>0.200</td>
<td>0.200</td>
<td>mg/kg</td>
<td>04.16.18 17:06</td>
<td>U</td>
<td>1</td>
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<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>&lt;3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>mg/kg</td>
<td>04.16.18 17:06</td>
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**Sample Id:** 7642830-1-BLK  
**Lab Sample Id:** 7642830-1-BLK  
**Matrix:** SOLID  

**Analytical Method:** Nitrogen, Nitrate-Nitrite by EPA 353.2  
**Tech:** KCS  
**Analyst:** KCS  
**Date Prep:** 04.18.18 09:30  
**Seq Number:** 3047014  
**Prep Method:** E353.2P  
**SUB:** TX104704215-18-24  

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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
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<tr>
<td>Nitrogen, Nitrate-Nitrite</td>
<td>7727-37-9</td>
<td>&lt;1.00</td>
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<td>mg/kg</td>
<td>04.18.18 10:29</td>
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### QC Summary 581927

**Fugro Consultants Inc. - Dallas**  
**Dining Hall**

#### Analytical Method: Organic Matter in Soil by ASTM D2974

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<th>Analysis Date</th>
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<tbody>
<tr>
<td>Organic Matter Reduction</td>
<td>0.0800</td>
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<td>04.17.18 12:00</td>
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#### Analytical Method: Organic Matter in Soil by ASTM D2974 (Parent Sample Id: 581927-001)

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<th>Analysis Date</th>
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<td>581927-001 D</td>
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#### Analytical Method: Total Metals by SW6020A

<table>
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<th>Spike Amount</th>
<th>LCS Result</th>
<th>LCS %Rec</th>
<th>LCSD Result</th>
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<th>RPD Limit</th>
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<th>Flag</th>
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<tr>
<td>Arsenic</td>
<td>&lt;0.200</td>
<td>10.0</td>
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#### Analytical Method: Total Metals by SW6020A (Parent Sample Id: 7642500-1-BKS)

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<th>LCS Result</th>
<th>LCS %Rec</th>
<th>LCSD Result</th>
<th>LCSD %Rec</th>
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<th>Flag</th>
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<td>92</td>
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<td>9.27</td>
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**Analytical Method:** Total Metals by SW6020A  
**Seq Number:** 3046597  
**Parent Sample Id:** 581761-001  
**Matrix:** Soil  
**Prep Method:** SW3050B  
**Date Prep:** 04.12.18

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<th>RPD Limit</th>
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<td>97.1</td>
<td>132</td>
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<td>110</td>
<td>70-125</td>
<td>3</td>
<td>30</td>
<td>mg/kg</td>
<td>04.12.18 23:07 X</td>
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</tr>
<tr>
<td>Copper</td>
<td>74.2</td>
<td>10.1</td>
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<tr>
<td>Lead</td>
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<td>16</td>
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<td>mg/kg</td>
<td>04.12.18 23:07 X</td>
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<tr>
<td>Zinc</td>
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<td>10.1</td>
<td>127</td>
<td>281</td>
<td>112</td>
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<td>13</td>
<td>30</td>
<td>mg/kg</td>
<td>04.12.18 23:07 X</td>
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</table>

**Analytical Method:** Cation-Exchange Capacity of Soils (Sodium Acetate)  
**Seq Number:** 3046957  
**Parent Sample Id:** 581927-001  
**Matrix:** Soil  
**Prep Method:** E351.2P  
**Date Prep:** 04.13.18 16:40

<table>
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<tr>
<th>Parameter</th>
<th>Parent Result</th>
<th>MD Result</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cation-Exchange Capacity</td>
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<td>277</td>
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<td>20</td>
<td>meq/100g</td>
<td>04.17.18 18:14</td>
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</table>

**Analytical Method:** Nitrogen, Kjeldahl, Total (Colorime by EPA 351.2)  
**Seq Number:** 3046670  
**Parent Sample Id:** 581927-001  
**Matrix:** Solid  
**Prep Method:** E351.2P  
**Date Prep:** 04.13.18 16:44

<table>
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<th>Parameter</th>
<th>MB Result</th>
<th>Spike Amount</th>
<th>LCS Result</th>
<th>LCS %Rec</th>
<th>LCSD Result</th>
<th>LCSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Total Kjeldahl 1</td>
<td>&lt;40.0</td>
<td>200</td>
<td>201</td>
<td>101</td>
<td>195</td>
<td>98</td>
<td>90-110</td>
<td>3</td>
<td>20</td>
<td>mg/kg</td>
<td>04.13.18 16:40</td>
</tr>
</tbody>
</table>

**Analytical Method:** Nitrogen, Kjeldahl, Total (Colorime by EPA 351.2)  
**Seq Number:** 3046670  
**Parent Sample Id:** 581927-001  
**Matrix:** Soil  
**Prep Method:** E351.2P  
**Date Prep:** 04.13.18 16:44

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<th>LCS %Rec</th>
<th>LCSD Result</th>
<th>LCSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Total Kjeldahl 2</td>
<td>255</td>
<td>200</td>
<td>400</td>
<td>73</td>
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<td>90-110</td>
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<td>mg/kg</td>
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**Analytical Method:** Nitrogen, Nitrate-Nitrite by EPA 353.2  
**Seq Number:** 3047014  
**Parent Sample Id:** 7642830-1-BLK  
**Matrix:** Solid  
**Prep Method:** E353.2P  
**Date Prep:** 04.18.18

<table>
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<th>LCS Result</th>
<th>LCS %Rec</th>
<th>LCSD Result</th>
<th>LCSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Nitrate-Nitrite</td>
<td>&lt;1.00</td>
<td>10.0</td>
<td>10.4</td>
<td>104</td>
<td>10.1</td>
<td>101</td>
<td>85-115</td>
<td>3</td>
<td>20</td>
<td>mg/kg</td>
<td>04.18.18 10:30</td>
</tr>
</tbody>
</table>

MS/MSD Percent Recovery: \[D = \frac{100 \times (C-A)}{B}\]  
Relative Percent Difference: \[RDP = \frac{200 \times |C-E|}{C+E}\]  
LCS/LCSD Recovery: \[D = \frac{100 \times C}{B}\]  
LCS = Laboratory Control Sample  
E = MSD/LCSD Result  
MS = Matrix Spike
## QC Summary 581927

**Fugro Consultants Inc. - Dallas**

**Dining Hall**

### Analytical Method: Nitrogen, Nitrate-Nitrite by EPA 353.2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parent Result</th>
<th>Spike Amount</th>
<th>MS Result</th>
<th>MS %Rec</th>
<th>MSD Result</th>
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<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, Nitrate-Nitrite</td>
<td>1.03</td>
<td>9.96</td>
<td>10.0</td>
<td>90</td>
<td>10.2</td>
<td>92</td>
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<td>mg/kg</td>
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**Prep Method:** E353.2P  
**Date Prep:** 04.18.18

### Analytical Method: Specific Conductance by SW-846 9050A

<table>
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<tr>
<th>Parameter</th>
<th>MB Result</th>
<th>Spike Amount</th>
<th>LSC Result</th>
<th>LSC %Rec</th>
<th>LCSD Result</th>
<th>LCSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>&lt;2.00</td>
<td>1410</td>
<td>1410</td>
<td>100</td>
<td>1410</td>
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<td>20</td>
<td>uS/cm</td>
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**Prep Method:** E353.2PPrep  
**Date Prep:** 04.18.18

### Analytical Method: Specific Conductance by SW-846 9050A

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MD Result</th>
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<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
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<td>0</td>
<td>20</td>
<td>uS/cm</td>
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**Prep Method:** E353.2PPrep  
**Date Prep:** 04.18.18

### Analytical Method: Sulfate by SW-846 9038

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parent Result</th>
<th>Spike Amount</th>
<th>MS Result</th>
<th>MS %Rec</th>
<th>MSD Result</th>
<th>MSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfate</td>
<td>223</td>
<td>198</td>
<td>425</td>
<td>102</td>
<td>409</td>
<td>95</td>
<td>75-125</td>
<td>4</td>
<td>20</td>
<td>mg/kg</td>
<td>04.12.18 09:50</td>
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**Prep Method:** E353.2PPrep  
**Date Prep:** 04.18.18

### Analytical Method: Sulfate by SW-846 9038

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parent Result</th>
<th>Spike Amount</th>
<th>MS Result</th>
<th>MS %Rec</th>
<th>MSD Result</th>
<th>MSD %Rec</th>
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<th>%RPD</th>
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<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
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<tbody>
<tr>
<td>Sulfate</td>
<td>223</td>
<td>198</td>
<td>425</td>
<td>102</td>
<td>409</td>
<td>95</td>
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<td>20</td>
<td>mg/kg</td>
<td>04.12.18 09:50</td>
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</table>

**Prep Method:** E353.2PPrep  
**Date Prep:** 04.18.18

---

**MS/MSD Percent Recovery**  
[D] = 100*(C-A) / B  
LCS = Laboratory Control Sample  
MS = Matrix Spike  
C = MS/LCS Result  
A = Parent Result  
B = Spike Added  
D = MSD/LCSD % Rec  
E = MSD/LCSD Result  

**Relative Percent Difference**  
[D] = 100 * (C-E) / (C+E)  

---

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Final 1.000
## QC Summary

**Fugro Consultants Inc. - Dallas**

### Dining Hall

#### Analytical Method: TOC in Soils by Walkley Black

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MB Result</th>
<th>Spike Amount</th>
<th>LCS Result</th>
<th>LCS %Rec</th>
<th>LCSD Result</th>
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<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
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</thead>
<tbody>
<tr>
<td>Total Organic Carbon</td>
<td>&lt;0.500</td>
<td>1000</td>
<td>958</td>
<td>96</td>
<td>998</td>
<td>100</td>
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<td>4</td>
<td>30</td>
<td>mg/kg</td>
<td>04.17.18 14:00</td>
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#### Analytical Method: TOC in Soils by Walkley Black

<table>
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<th>Spike Amount</th>
<th>LCS Result</th>
<th>LCS %Rec</th>
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<th>LCSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
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<tr>
<td>Total Organic Carbon</td>
<td>&lt;0.500</td>
<td>&lt;0.500</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>04.17.18 14:00</td>
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#### Analytical Method: SVOAs by EPA 8270C

<table>
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<th>LCS Result</th>
<th>LCS %Rec</th>
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<th>LCSD %Rec</th>
<th>Limits</th>
<th>%RPD</th>
<th>RPD Limit</th>
<th>Units</th>
<th>Analysis Date</th>
<th>Flag</th>
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</thead>
<tbody>
<tr>
<td>2-methylphenol</td>
<td>&lt;0.167</td>
<td>1.67</td>
<td>1.24</td>
<td>74</td>
<td>1.15</td>
<td>69</td>
<td>37-128</td>
<td>8</td>
<td>30</td>
<td>mg/kg</td>
<td>04.11.18 21:48</td>
<td></td>
</tr>
<tr>
<td>3&amp;4-Methylphenol</td>
<td>&lt;0.167</td>
<td>1.67</td>
<td>1.24</td>
<td>74</td>
<td>1.14</td>
<td>68</td>
<td>38-126</td>
<td>8</td>
<td>30</td>
<td>mg/kg</td>
<td>04.11.18 21:48</td>
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<tr>
<td>Pentachlorophenol</td>
<td>&lt;0.333</td>
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<td>1.29</td>
<td>77</td>
<td>1.27</td>
<td>76</td>
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<td>04.11.18 21:48</td>
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#### Surrogate

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<th>LCS Flag</th>
<th>LCSD %Rec</th>
<th>LCSD Flag</th>
<th>Limits</th>
<th>Units</th>
<th>Analysis Date</th>
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</thead>
<tbody>
<tr>
<td>2-Fluorophenol</td>
<td>81</td>
<td>85</td>
<td>78</td>
<td>25-121</td>
<td>%</td>
<td>04.11.18 21:48</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Phenol-d6</td>
<td>82</td>
<td>83</td>
<td>77</td>
<td>24-113</td>
<td>%</td>
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<tr>
<td>Nitrobenzene-d5</td>
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<td>80</td>
<td>75</td>
<td>23-120</td>
<td>%</td>
<td>04.11.18 21:48</td>
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<td></td>
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<tr>
<td>2-Fluorobiphenyl</td>
<td>84</td>
<td>84</td>
<td>78</td>
<td>30-115</td>
<td>%</td>
<td>04.11.18 21:48</td>
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<tr>
<td>2,4,6-Tribromophenol</td>
<td>86</td>
<td>98</td>
<td>92</td>
<td>19-122</td>
<td>%</td>
<td>04.11.18 21:48</td>
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<tr>
<td>Terphenyl-D14</td>
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<td>94</td>
<td>87</td>
<td>18-137</td>
<td>%</td>
<td>04.11.18 21:48</td>
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</table>
# QC Summary 581927

**Fugro Consultants Inc. - Dallas**  
Dining Hall

## Analytical Method: SVOAs by EPA 8270C

Seq Number: 3046586  
Parent Sample Id: 581932-001  
Matrix: Soil  
MS Sample Id: 581932-001 S  
Prep Method: SW3550  
Date Prep: 04.11.18  
MSD Sample Id: 581932-001 SD

### Parameter

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<th>Spike Amount</th>
<th>MS Result</th>
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<th>MSD Result</th>
<th>MSD %Rec</th>
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<td>04.12.18 14:14</td>
</tr>
<tr>
<td>3&amp;4-Methylphenol</td>
<td>&lt;1.48</td>
<td>14.8</td>
<td>6.70</td>
<td>45</td>
<td>6.57</td>
<td>44</td>
<td>38-126</td>
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</tr>
<tr>
<td>Pentachlorophenol</td>
<td>&lt;2.96</td>
<td>14.8</td>
<td>12.0</td>
<td>81</td>
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### Surrogate

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<th>MSD Flag</th>
<th>Limits</th>
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<tbody>
<tr>
<td>2-Fluorophenol</td>
<td>50</td>
<td>54</td>
<td></td>
<td></td>
<td>25-121</td>
<td>%</td>
<td>04.12.18 14:14</td>
</tr>
<tr>
<td>Phenol-d6</td>
<td>50</td>
<td>53</td>
<td></td>
<td></td>
<td>24-113</td>
<td>%</td>
<td>04.12.18 14:14</td>
</tr>
<tr>
<td>Nitrobenzene-d5</td>
<td>53</td>
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<td>23-120</td>
<td>%</td>
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<tr>
<td>2-Fluorobiphenyl</td>
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<td></td>
<td></td>
<td>30-115</td>
<td>%</td>
<td>04.12.18 14:14</td>
</tr>
<tr>
<td>2,4,6-Tribromophenol</td>
<td>95</td>
<td>95</td>
<td></td>
<td></td>
<td>19-122</td>
<td>%</td>
<td>04.12.18 14:14</td>
</tr>
<tr>
<td>Terphenyl-D14</td>
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<td>84</td>
<td></td>
<td></td>
<td>18-137</td>
<td>%</td>
<td>04.12.18 14:14</td>
</tr>
</tbody>
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---

MS/MSD Percent Recovery: 
- \( D = \frac{100 \times (C-A)}{B} \)
- LCS = Laboratory Control Sample
- MS = Matrix Spike
- Relative Percent Difference: \( RPD = \frac{200 \times |(C-E)/(C+E)|}{|C+E|} \)
- LCS/LCSD Recovery: 
  - \( D = \frac{100 \times (C-B)}{B} \)
  - LCS = MS/LCS Result
  - MS = MSD/LCSD Result

---

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Flagging Criteria

X In our quality control review of the data a QC deficiency was observed and flagged as noted. MS/MSD recoveries were found to be outside of the laboratory control limits due to possible matrix/chemical interference, or a concentration of target analyte high enough to affect the recovery of the spike concentration. This condition could also affect the relative percent difference in the MS/MSD.

B A target analyte or common laboratory contaminant was identified in the method blank. Its presence indicates possible field or laboratory contamination.

D The sample(s) were diluted due to targets detected over the highest point of the calibration curve, or due to matrix interference. Dilution factors are included in the final results. The result is from a diluted sample.

E The data exceeds the upper calibration limit; therefore, the concentration is reported as estimated.

F RPD exceeded lab control limits.

J The target analyte was positively identified below the quantitation limit and above the detection limit.

U Analyte was not detected.

L The LCS data for this analytical batch was reported below the laboratory control limits for this analyte. The department supervisor and QA Director reviewed data. The samples were either reanalyzed or flagged as estimated concentrations.

H The LCS data for this analytical batch was reported above the laboratory control limits. Supporting QC Data were reviewed by the Department Supervisor and QA Director. Data were determined to be valid for reporting.

K Sample analyzed outside of recommended hold time.

JN A combination of the "N" and the "J" qualifier. The analysis indicates that the analyte is "tentatively identified" and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

** Surrogate recovered outside laboratory control limit.

BRL Below Reporting Limit.

RL Reporting Limit

MDL Method Detection Limit SDL Sample Detection Limit LOD Limit of Detection

PQL Practical Quantitation Limit MQL Method Quantitation Limit LOQ Limit of Quantitation

DL Method Detection Limit

NC Non-Calculable

SMP Client Sample BLK Method Blank

BKS/LCS Blank Spike/Laboratory Control Sample BKSD/LCSD Blank Spike Duplicate/Laboratory Control Sample Duplicate

MD/SD Method Duplicate/Sample Duplicate MS Matrix Spike MSD Matrix Spike Duplicate

+ NELAC certification not offered for this compound.

* (Next to analyte name or method description) = Outside XENCO's scope of NELAC accreditation
**Inter-Office Shipment**

**IOS Number** 1058929

**Date/Time:** 04/10/18 16:52

**Lab# From:** Dallas

**Lab# To:** Houston

**Created by:** Angelica Martinez

**Delivery Priority:** Fedex

**Air Bill No.:** 771964929950

---

<table>
<thead>
<tr>
<th>Sample Id</th>
<th>Matrix</th>
<th>Client Sample Id</th>
<th>Sample Collection</th>
<th>Method</th>
<th>Method Name</th>
<th>Lab Due</th>
<th>HT Due</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>SW9081</td>
<td>Cation-Exchange Capacity of Soils (Sodium)</td>
<td>04/16/18</td>
<td>05/07/18</td>
<td>WEW</td>
</tr>
<tr>
<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>SW6020</td>
<td>Total Metals by SW6020A</td>
<td>04/16/18</td>
<td>10/06/18</td>
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<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>SW9056A</td>
<td>Inorganic Anions by SW 9056</td>
<td>04/16/18</td>
<td>05/20/18</td>
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<tr>
<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>SM2520B</td>
<td>Salinity by SM2520B</td>
<td>04/16/18</td>
<td>05/07/18</td>
<td>WEW</td>
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<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>SW8270C</td>
<td>SVOAs by EPA 8270C</td>
<td>04/16/18</td>
<td>04/23/18</td>
<td>WEW</td>
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<tr>
<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>E351.2</td>
<td>Nitrogen, Kjeldahl, Total (Colorime by EP)</td>
<td>04/16/18</td>
<td>05/07/18</td>
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<tr>
<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>SG90.3</td>
<td>TOC in Soils by Walkley Black</td>
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<tr>
<td>581927-001</td>
<td>S</td>
<td>B-1 14'-15'</td>
<td>04/09/18 13:50</td>
<td>TN</td>
<td>Total Nitrogen</td>
<td>04/16/18</td>
<td>04/09/19</td>
<td>WEW</td>
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<td>581927-002</td>
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<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>SW8270C</td>
<td>SVOAs by EPA 8270C</td>
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<td>04/23/18</td>
<td>WEW</td>
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<td>S</td>
<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>SW6020</td>
<td>Total Metals by SW6020A</td>
<td>04/16/18</td>
<td>10/06/18</td>
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<tr>
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<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>SM2520B</td>
<td>Salinity by SM2520B</td>
<td>04/16/18</td>
<td>05/07/18</td>
<td>WEW</td>
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<tr>
<td>581927-002</td>
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<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>SG90.3</td>
<td>TOC in Soils by Walkley Black</td>
<td>04/16/18</td>
<td>05/07/18</td>
<td>WEW</td>
</tr>
<tr>
<td>581927-002</td>
<td>S</td>
<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>TN</td>
<td>Total Nitrogen</td>
<td>04/16/18</td>
<td>04/09/19</td>
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<tr>
<td>581927-002</td>
<td>S</td>
<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>E351.2</td>
<td>Nitrogen, Kjeldahl, Total (Colorime by EP)</td>
<td>04/16/18</td>
<td>05/07/18</td>
<td>WEW</td>
</tr>
<tr>
<td>581927-002</td>
<td>S</td>
<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>SW9056A</td>
<td>Inorganic Anions by SW 9056</td>
<td>04/16/18</td>
<td>05/20/18</td>
<td>WEW</td>
</tr>
<tr>
<td>581927-002</td>
<td>S</td>
<td>B-4 f-6</td>
<td>04/09/18 15:30</td>
<td>SW9081</td>
<td>Cation-Exchange Capacity of Soils (Sodium)</td>
<td>04/16/18</td>
<td>05/07/18</td>
<td>WEW</td>
</tr>
</tbody>
</table>

---

**Sample Collection**

04/09/18 13:50

**Method Name**

- Cation-Exchange Capacity of Soils (Sodium)
- Total Metals by SW6020A
- Inorganic Anions by SW 9056
- Salinity by SM2520B
- SVOAs by EPA 8270C
- Nitrogen, Kjeldahl, Total (Colorime by EP)
- TOC in Soils by Walkley Black
- Total Nitrogen
- SVOAs by EPA 8270C
- Total Metals by SW6020A
- Salinity by SM2520B
- TOC in Soils by Walkley Black
- Total Nitrogen
- Nitrogen, Kjeldahl, Total (Colorime by EP)
- Inorganic Anions by SW 9056
- Cation-Exchange Capacity of Soils (Sodium)

**Method**

- SW9081
- SW6020
- SW9056A
- SM2520B
- SW8270C
- E351.2
- SG90.3
- TN
- SW8270C
- SW6020
- SM2520B
- SG90.3
- TN
- E351.2
- SW9056A
- SW9081

**Sample Id**

- 581927-001
- 581927-002

---

**Inter Office Shipment Comments**

**Relinquished By:** Angelica Martinez

**Date Relinquished:** 04/10/2018

**Received By:** Monica Shakhshir

**Date Received:** 04/11/2018 09:30

**Cooler Temperature:** 0.9
**Sample Receipt Checklist**

<table>
<thead>
<tr>
<th>#</th>
<th>Item</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature of cooler(s)?</td>
<td>.9</td>
</tr>
<tr>
<td>2</td>
<td>Shipping container in good condition?</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Samples received with appropriate temperature?</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Custody Seals intact on shipping container/ cooler?</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Custody Seals Signed and dated for Containers/coolers</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>IOS present?</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Any missing/extra samples?</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>IOS agrees with sample label(s)/matrix?</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Sample matrix/ properties agree with IOS?</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Samples in proper container/ bottle?</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>Samples properly preserved?</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>Sample container(s) intact?</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>Sufficient sample amount for indicated test(s)?</td>
<td>Yes</td>
</tr>
<tr>
<td>14</td>
<td>All samples received within hold time?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Must be completed for after-hours delivery of samples prior to placing in the refrigerator

**NonConformance:**

**Corrective Action Taken:**

**Nonconformance Documentation**

<table>
<thead>
<tr>
<th>Contact:</th>
<th>Contacted by:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Checklist reviewed by: 

Monica Shakhshir  
Date: 04/11/2018
Client: Fugro Consultants Inc. - Dallas
Date/ Time Received: 04/10/2018 03:50:17 PM

Sample Receipt Checklist

<table>
<thead>
<tr>
<th>Sample Receipt Checklist</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 *Temperature of cooler(s)?</td>
<td></td>
</tr>
<tr>
<td>#2 *Shipping container in good condition?</td>
<td>Yes</td>
</tr>
<tr>
<td>#3 *Samples received on ice?</td>
<td>No</td>
</tr>
<tr>
<td>#4 *Custody Seals intact on shipping container/ cooler?</td>
<td>No</td>
</tr>
<tr>
<td>#5 Custody Seals intact on sample bottles?</td>
<td>N/A</td>
</tr>
<tr>
<td>#6 Custody Seals Signed and dated?</td>
<td>N/A</td>
</tr>
<tr>
<td>#7 *Chain of Custody present?</td>
<td>Yes</td>
</tr>
<tr>
<td>#8 Any missing/extra samples?</td>
<td>No</td>
</tr>
<tr>
<td>#9 Chain of Custody signed when relinquished/ received?</td>
<td>Yes</td>
</tr>
<tr>
<td>#10 Chain of Custody agrees with sample labels/matrix?</td>
<td>Yes</td>
</tr>
<tr>
<td>#11 Container label(s) legible and intact?</td>
<td>Yes</td>
</tr>
<tr>
<td>#12 Samples in proper container/ bottle?</td>
<td>Yes</td>
</tr>
<tr>
<td>#13 Samples properly preserved?</td>
<td>Yes</td>
</tr>
<tr>
<td>#14 Sample container(s) intact?</td>
<td>Yes</td>
</tr>
<tr>
<td>#15 Sufficient sample amount for indicated test(s)?</td>
<td>Yes</td>
</tr>
<tr>
<td>#16 All samples received within hold time?</td>
<td>Yes</td>
</tr>
<tr>
<td>#17 Subcontract of sample(s)?</td>
<td>Yes</td>
</tr>
<tr>
<td>#18 Water VOC samples have zero headspace?</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Must be completed for after-hours delivery of samples prior to placing in the refrigerator

Analyst: Angelica Martinez

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient
Temperature Measuring device used: XDA

Checklist completed by: Angelica Martinez
Date: 04/10/2018

Checklist reviewed by: Wendy Walfoort
Date: 04/16/2018
June 1, 2018

UNT System
Facilities Planning and Construction
1155 Union Circle, Suite 311040
Denton, Texas 76203

Re: Fugro Project No. 04.40171085

Attention: Mr. Andrew Herrell, AIA, LEED GA
Project Manager

ADDENDUM NO. 1
GEOTECHNICAL INVESTIGATION
DINING HALL
UNIVERSITY OF NORTH TEXAS
DENTON, TEXAS

Dear Mr. Herrell:

This letter is an addendum to our geotechnical engineering report for the above referenced project (Fugro Project No. 04.40171085, dated April 18, 2018). The results of two permeability tests (Plates 16 and 17) included in this addendum should be considered supplemental to the information contained in the original report.

We appreciate the opportunity to be of assistance on this project. Please contact us if you have any question or if we can be of further service.

Sincerely,

FUGRO USA LAND, INC.
TBPE Firm Registration No. F-299

Che-Hung (Chris) Tsai, PhD, PE
Senior Project Manager

Segu I. Ifham, PE
Geotechnical Engineering Manager

Enclosures: Plates 16 and 17.
### Applied Pressures:

<table>
<thead>
<tr>
<th>Initial</th>
<th>Final</th>
<th>Inlet</th>
<th>90.00 psi</th>
<th>Confining</th>
<th>93.00 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>235.64 g</td>
<td>249.17 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.155 in.</td>
<td>2.235 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>132.7 pcf</td>
<td>132.3 pcf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>109.9 pcf</td>
<td>106.4 pcf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.999 in.</td>
<td>2.021 in.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.8 %</td>
<td>24.4 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Test Results

**ASTM D 5084**

*Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter Method A - Constant Head*

**Sample:**

<table>
<thead>
<tr>
<th>Initial</th>
<th>Final</th>
<th>APPLIED PRESSURES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight:</td>
<td>235.64 g</td>
<td>Inlet: 90.00 psi</td>
</tr>
<tr>
<td>Height:</td>
<td>2.155 in.</td>
<td>Confining: 93.00 psi</td>
</tr>
<tr>
<td>Diameter:</td>
<td>1.999 in.</td>
<td>Outlet: 88.00 psi</td>
</tr>
<tr>
<td>MC:</td>
<td>20.8 %</td>
<td>1.999 in.</td>
</tr>
<tr>
<td>Dry Density:</td>
<td>109.9 pcf</td>
<td>20.8 %</td>
</tr>
<tr>
<td>Void Ratio:</td>
<td>0.561</td>
<td>109.9 pcf</td>
</tr>
<tr>
<td>Saturation:</td>
<td>100.0 %</td>
<td>20.8 %</td>
</tr>
</tbody>
</table>

**Assumed Sp. Gr.:** 2.750

**INFLUENT PIPETTE**

- Diameter: 1.128 cm
- Area: 3.21 in²
- Volume: 6.92 in³
- Solid Volume: 4.45 in³
- Pore Volume: 40.41 cm³
- Average water temp.: 23.42°C

**EFFLUENT PIPETTE**

- Diameter: 1.128 cm
- Area: 1.00 cm²
- Volume: 3.831E-09 cm³
- Solid Volume: 3.869E-09 cm³
- Pore Volume: 3.832E-09 cm³
- Average water temp.: 23.42°C

**Test Results:**

**Initial:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Date</th>
<th>Time</th>
<th>(l_0) (cm)</th>
<th>(E_0) (cm)</th>
<th>(l_f) (cm)</th>
<th>(E_f) (cm)</th>
<th>Temp. (°C)</th>
<th>Time (min.)</th>
<th>(\Delta Q) (cm³)</th>
<th>(k) (cm/sec)</th>
<th>(k) at 20°C (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/18/2018</td>
<td>19:02:00</td>
<td>4/20/2018</td>
<td>16:25:00</td>
<td>10.85</td>
<td>9.71</td>
<td>11.01</td>
<td>9.61</td>
<td>23.4</td>
<td>2723.00</td>
<td>0.13</td>
<td>1.552E-09</td>
<td>1.431E-09</td>
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<tr>
<td>4/20/2018</td>
<td>16:25:00</td>
<td>4/23/2018</td>
<td>9:20:00</td>
<td>11.01</td>
<td>9.61</td>
<td>11.50</td>
<td>9.40</td>
<td>22.4</td>
<td>3895.00</td>
<td>0.35</td>
<td>2.920E-09</td>
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<tr>
<td>4/23/2018</td>
<td>9:20:00</td>
<td>4/24/2018</td>
<td>6:55:00</td>
<td>11.50</td>
<td>9.40</td>
<td>11.69</td>
<td>9.29</td>
<td>23.1</td>
<td>1295.00</td>
<td>0.15</td>
<td>3.764E-09</td>
<td>3.497E-09</td>
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<tr>
<td>4/24/2018</td>
<td>6:55:00</td>
<td>4/27/2018</td>
<td>16:30:00</td>
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<td>9.29</td>
<td>12.28</td>
<td>8.82</td>
<td>23.4</td>
<td>4895.00</td>
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<td>3.519E-09</td>
<td>3.246E-09</td>
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<tr>
<td>4/27/2018</td>
<td>16:30:00</td>
<td>4/28/2018</td>
<td>20:10:00</td>
<td>12.28</td>
<td>8.82</td>
<td>12.45</td>
<td>8.68</td>
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<td>1660.00</td>
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<td>3.035E-09</td>
<td>2.761E-09</td>
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<td>4/28/2018</td>
<td>20:10:00</td>
<td>4/30/2018</td>
<td>16:00:00</td>
<td>12.45</td>
<td>8.68</td>
<td>12.80</td>
<td>8.41</td>
<td>23.6</td>
<td>2630.00</td>
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<td>3.518E-09</td>
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<tr>
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<td>16:00:00</td>
<td>5/1/2018</td>
<td>17:13:00</td>
<td>12.80</td>
<td>8.41</td>
<td>13.02</td>
<td>8.30</td>
<td>23.5</td>
<td>1513.00</td>
<td>0.16</td>
<td>3.544E-09</td>
<td>3.262E-09</td>
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<tr>
<td>5/1/2018</td>
<td>17:13:00</td>
<td>5/3/2018</td>
<td>14:20:00</td>
<td>13.02</td>
<td>8.30</td>
<td>13.41</td>
<td>8.02</td>
<td>23.6</td>
<td>2707.00</td>
<td>0.34</td>
<td>4.022E-09</td>
<td>3.693E-09</td>
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<tr>
<td>5/3/2018</td>
<td>14:20:00</td>
<td>5/4/2018</td>
<td>16:50:00</td>
<td>13.41</td>
<td>8.02</td>
<td>13.66</td>
<td>7.83</td>
<td>23.6</td>
<td>1590.00</td>
<td>0.22</td>
<td>4.497E-09</td>
<td>4.129E-09</td>
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<tr>
<td>5/4/2018</td>
<td>16:50:00</td>
<td>5/7/2018</td>
<td>18:20:00</td>
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<td>7.83</td>
<td>14.29</td>
<td>7.41</td>
<td>23.5</td>
<td>4410.00</td>
<td>0.52</td>
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<td>3.561E-09</td>
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<tr>
<td>5/7/2018</td>
<td>18:20:00</td>
<td>5/8/2018</td>
<td>14:15:00</td>
<td>14.29</td>
<td>7.41</td>
<td>14.49</td>
<td>7.29</td>
<td>23.5</td>
<td>1195.00</td>
<td>0.16</td>
<td>4.351E-09</td>
<td>4.005E-09</td>
</tr>
</tbody>
</table>

**Weighted Averages:**

Hydraulic Conductivity, \(k\):

- Value: 4.070E-09
- Value: 3.742E-09

Hydraulic Conductivity at 20°C, \(k_{20}\):

- Value: 3.742E-09
- Value: 4.005E-09

**Tested by:** TP  **Date:** 5/15/2018
**Checked by:** CT  **Date:** 5/15/2018
### Applied Pressures:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Initial</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>237.95</td>
<td>243.03</td>
</tr>
<tr>
<td>Height (in)</td>
<td>2.092</td>
<td>2.132</td>
</tr>
<tr>
<td>Diameter (in)</td>
<td>2.007</td>
<td>2.018</td>
</tr>
<tr>
<td>MC (%)</td>
<td>19.4</td>
<td>18.5</td>
</tr>
<tr>
<td>Wet Density (pcf)</td>
<td>137.0</td>
<td>135.8</td>
</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>114.8</td>
<td>114.6</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.495</td>
<td>0.498</td>
</tr>
<tr>
<td>Saturation (%)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Influent Pipette**
- Diameter: 1.128 cm
- Area: 3.20 in²
- Volume: 6.69 in³
- Solid Volume: 4.57 in³
- Pore Volume: 34.75 cm³
- Average water temp. at 23.42°C

**Effluent Pipette**
- Diameter: 1.128 cm
- Area: 1.00 cm²

### Hydraulic Conductivity

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>ΔQ</th>
<th>k (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/18/2018</td>
<td>11.71</td>
<td>2.723.00</td>
</tr>
<tr>
<td>4/20/2018</td>
<td>11.08</td>
<td>2.3895.00</td>
</tr>
<tr>
<td>4/23/2018</td>
<td>11.42</td>
<td>2.1295.00</td>
</tr>
<tr>
<td>4/24/2018</td>
<td>11.70</td>
<td>2.4895.00</td>
</tr>
<tr>
<td>4/27/2018</td>
<td>11.70</td>
<td>2.1660.00</td>
</tr>
<tr>
<td>4/28/2018</td>
<td>11.50</td>
<td>2.2630.00</td>
</tr>
<tr>
<td>4/30/2018</td>
<td>11.50</td>
<td>2.1513.00</td>
</tr>
<tr>
<td>5/1/2018</td>
<td>11.50</td>
<td>2.2707.00</td>
</tr>
<tr>
<td>5/3/2018</td>
<td>11.50</td>
<td>2.1590.00</td>
</tr>
<tr>
<td>5/4/2018</td>
<td>11.50</td>
<td>2.4410.00</td>
</tr>
<tr>
<td>5/7/2018</td>
<td>11.50</td>
<td>2.1195.00</td>
</tr>
</tbody>
</table>

**Weighted Averages:**
- k: 6.896E-09 (cm/sec)
- k: 6.341E-09 (cm/sec)
ADDENDUM NO. 2
GEOTECHNICAL INVESTIGATION
DINING HALL
UNIVERSITY OF NORTH TEXAS
DENTON, TEXAS

Dear Ms. Vail:

This letter is an addendum to our geotechnical engineering report for the above referenced project (Fugro Project No. 04.40171085, dated April 18, 2018). The information included in this addendum should be considered supplemental to the information contained in the original report and, as such, should be read in conjunction with the above referenced report. The design and construction recommendations presented herein are intended to supersede only the corresponding specific recommendations in the original report and subsequently issued addenda. All the remaining recommendations of the original report should and subsequently issued addenda be considered valid.

The original study consisted of two borings to a depth of 40 feet. An additional boring (B-3) was advanced to a depth of 50 feet at the southeast corner of the project site. Approximate locations of the borings are shown on Plate 1, Site and Boring Plan. Logs of the borings are presented on Plates 2 through 4.
Based on surface conditions encountered in the borings, gray shale was encountered at a depth of 23 feet in Boring B-1, 24 feet in Borings B-4, and 33 feet in Boring B-3. We understand that a maximum penetration of 16 feet into the gray shale will be required for the proposed drilled shafts. It is our opinion that the depths of borings are sufficient to design drilled shaft foundations with 16 feet penetration.

The recommended design parameters for straight drilled shafts provided in the original report are still valid and applicable. The skin friction values should be applied from 2 feet below the bearing stratum.

We appreciate the opportunity to be of assistance on this project. Please contact us if you have any question or if we can be of further service.

Sincerely,

FUGRO USA LAND, INC.
TBPE Firm Registration No. F-299

Che-Hung (Chris) Tsai, PhD, PE
Senior Project Manager

Segu I. Ifham, PE
Geotechnical Engineering Manager

Enclosures: Plates 1 through 4
### LOG OF BORING NO. B-1

**Date Drilled:** 4-9-18  
**Water Level / Seepage:** DRY  
**Water Level (Upon Completion):** DRY  
**Completion Depth:** 40.0  
**Plate:** 2a

**Location:** University of North Texas, Denton, Texas  
**Project No.:** 04.40171085

**Surf. Elevation:** Unknown  
**Longitude:** -97.14678  
**Latitude:** 33.20876

#### STRATUM DESCRIPTION

<table>
<thead>
<tr>
<th>Depth, FT</th>
<th>Layer Elev./Depth</th>
<th>Water Content, %</th>
<th>Liquid Limit, %</th>
<th>Plastic Limit, %</th>
<th>Plasticity Index (PI), %</th>
<th>Passing No. 200 Sieve, %</th>
<th>Unit Dry Weight, PCF</th>
<th>Soil Type</th>
<th>Rock (PSI)</th>
<th>Pocket Pen Blows/ft.</th>
<th>Rec./RQD, %</th>
<th>Compressive Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1.0</td>
<td>FILL, CLAY, dark brown and reddish brown, very stiff, with gravels</td>
<td>31</td>
<td>1.0</td>
<td>18</td>
<td>55</td>
<td>19</td>
<td>36</td>
<td>117</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0-8.0</td>
<td>FAT CLAY (CH), light brown and brownish gray, hard, with calcareous deposit seams and gravels</td>
<td>18</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td>FAT CLAY (CH), brownish gray, hard, shaley, with calcareous deposit seams</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-23</td>
<td>SHALE, gray</td>
<td>23.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** All depths are measured in feet.

**Key:**  
- P = Pocket Penetrometer
LOG OF BORING NO. B-1
Dining Hall
University of North Texas
Denton, Texas
PROJECT NO. 04.40171085

<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>LAYER ELEV./ DEPTH</th>
<th>WATER CONTENT, %</th>
<th>LIQUID LIMIT, %</th>
<th>PLASTIC LIMIT, %</th>
<th>PLASTICITY INDEX (PI), %</th>
<th>PASSING NO. 200 SIEVE, %</th>
<th>UNIT DRY WEIGHT, PCF</th>
<th>COMPRRESSIVE STRENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SURF. ELEVATION: Unknown

Note: All depths are measured in feet.

WATER LEVEL / SEEPAGE: DRY

COMPETENCY: 40.0

DATE DRILLED: 4-9-18

WATER LEVEL (UPON COMPLETION): DRY

KEY:
P = Pocket Penetrometer
N = Standard Penetration Resistance
**LOG OF BORING NO. B-3**

**Date Drilled:** 9-25-18  
**Water Level / Seepage:** DRY  
**Water Level (Upon Completion):** DRY

**Surf. Elevation:** Unknown

**Layer Elevation/Depth**

<table>
<thead>
<tr>
<th>Depth, FT</th>
<th>Stratum Description</th>
<th>Layer Elevation/Depth</th>
<th>Water Content, %</th>
<th>Liquid Limit, %</th>
<th>Plastic Limit, %</th>
<th>Plasticity Index (PI), %</th>
<th>Passing No. 200 Sieve, %</th>
<th>Unit Dry Weight,pcf</th>
<th>Compressive Strength, psi</th>
<th>Soil Type</th>
<th>Rock Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>FILL, SANDY LEAN CLAY, reddish brown and brown, with sand and gravel, soft</td>
<td>5.0</td>
<td>24</td>
<td>36</td>
<td>18</td>
<td>18</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>FAT CLAY (CH), light brown and brown, with ironic deposits, very stiff to hard</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>FAT CLAY (CH), brownish gray and light brown, with calcareous deposits, very stiff to hard</td>
<td>7.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>FAT CLAY (CH), brownish gray, shaley, hard</td>
<td>12.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Completions Depth:** 50.0

**Lat:** 33.2086  
**Lon:** -97.1466

**Dates:**  
- **10/1/18**
- **10/18/18**

**Rock Symbol:**  
- **SANDY LEAN CLAY**
- **FAT CLAY (CH)**
- **LIMESTONE**

**RQD**

<table>
<thead>
<tr>
<th>Depth, FT</th>
<th>Blows/ft.</th>
<th>Rec./RQD, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>100/9.25</td>
<td>100/9.25</td>
</tr>
</tbody>
</table>

Note: All depths are measured in feet.
LOG OF BORING NO. B-3

Dining Hall
University of North Texas
Denton, Texas
PROJECT NO. 04.40171085

LATITUDE: 33.20845
LONGITUDE: -97.14659

SURF. ELEVATION: Unknown

<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>SAMPLES</th>
<th>POCKET PEN BLows/ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FAT CLAY (CH), brownish gray, shaley, hard (continued)

<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>SAMPLES</th>
<th>POCKET PEN BLows/ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SHALE, gray

<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>SAMPLES</th>
<th>POCKET PEN BLows/ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COMPLETION DEPTH: 50.0
DATE DRILLED: 9-25-18

WATER LEVEL / SEEPAGE: DRY
WATER LEVEL (UPON COMPLETION): DRY

Note: All depths are measured in feet.

PLATE 3b
### Log of Boring No. B-4

**Dining Hall**
University of North Texas
Denton, Texas

**Project No. 04.40171085**

**Surf. Elevation:** Unknown

#### Stratum Description

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Layer Description</th>
<th>Water Content (%)</th>
<th>Liquid Limit (%)</th>
<th>Plastic Limit (%)</th>
<th>Plasticity Index (PI) (%)</th>
<th>Blows/ft.</th>
<th>Rec./RQD, %</th>
<th>Unit Dry Weight (pcf)</th>
<th>Compressive Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1.0</td>
<td>Fill, Clay, dark brown and reddish brown, stiff, with gravels</td>
<td>1.0</td>
<td>22</td>
<td>19</td>
<td>25 58 20 38 93 98</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0-2.0</td>
<td>Fat Clay (CH), brownish gray and light brown, stiff to hard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0-3.0</td>
<td>- Calcareous deposits and gravels at 8’ to 10’</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0-4.0</td>
<td>Fat Clay (CH), brownish gray, hard, shaley</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0-5.0</td>
<td>- With calcareous deposits and gravel, at 14’</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0-6.0</td>
<td>Shale, gray</td>
<td>10.0</td>
<td>23</td>
<td>108 4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0-7.0</td>
<td></td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0-8.0</td>
<td></td>
<td>24.0</td>
<td>17</td>
<td>115 4.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Completion Depth:** 40.0

**Date Drilled:** 4-9-18

**Water Level / Seepage:** DRY

**Water Level (Upon Completion):** DRY

**Key:**
- **P** = Pocket Penetrometer
- **N** = Standard Penetration Resistance

---

Note: All depths are measured in feet.
<table>
<thead>
<tr>
<th>DEPTH, FT</th>
<th>SYMBOL</th>
<th>SAMPLES</th>
<th>POCKET PEN BLows/ft.</th>
<th>REC./RQD, %</th>
<th>STRATUM DESCRIPTION</th>
<th>LAYER ELEV./ DEPTH</th>
<th>WATER CONTENT, %</th>
<th>LIQUID LIMIT, %</th>
<th>PLASTIC LIMIT, %</th>
<th>PLASTICITY INDEX (PI), %</th>
<th>PASSING NO. 200 SIEVE, %</th>
<th>UNIT DRY WEIGHT, PCF</th>
<th>COMPRESSION STRENGTH, PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SHALE, gray (continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DATE DRILLED:** 4-9-18

**WATER LEVEL / SEEPAGE:** DRY

**WATER LEVEL (UPON COMPLETION):** DRY

**COMPLETION DEPTH:** 40.0

**PROJECT NO. 04.40171085**

**LATITUDE:** 33.20883

**LONGITUDE:** -97.14642

**Surf. Elevation:** Unknown

**Unit Dry Weight:** PCF

**Compressive Strength:** PSI

**Passing No. 200 Sieve:** %

**Plasticity Index (PI):** %

**Plastic Limit:** %

**Liquid Limit:** %

**Water Content:** %

**Pocket Pen Blows/ft.:**

**Rec./RQD:** %

**Layer Elev./Depth:**

**Water Level / Seepage:** DRY

**Water Level (Upon Completion):** DRY

**Completion Depth:** 40.0

**Note:** All depths are measured in feet.

**Key:**

- P = Pocket Penetrometer
- N = Standard Penetration Resistance

**PLATE 4b**
Proposal of: _______________________________
(Company Name)

In accordance with Education Code 51.783, the University of North Texas System (UNTS), subsequently referred to as the Owner, is accepting proposals and intends to enter into an agreement with a General Construction contractor in accordance with the terms, conditions and requirements set forth in this Request for Competitive Sealed Proposal (RFCSP).

UNTS is accepting sealed bids no later than 2:00p.m. CDT on June 14, 2021. Bids received after the date and hour previously stated will not receive consideration. The HUB Sub-Contracting Plan is due no later than 2:00p.m. CDT on June 15, 2021. Failure to submit the HUB plan will disqualify your proposal.

The scope of work of this RFCSP is General Construction for the UNT New Dining Hall Retail Space Buildout project. A set of the one hundred percent (100%) Construction Documents and Specifications have been included for use in preparation of the proposal. A sample copy of the agreement has been included (Division 00, Section 005200, Agreement Forms) for review.

PROPOSERS ARE CAUTIONED TO READ THE INFORMATION CONTAINED OR REFERRED TO IN THIS RFCSP CAREFULLY AND TO SUBMIT A COMPLETE RESPONSE TO ALL REQUIREMENTS AS DIRECTED.

Via hand delivery or overnight delivery only (Preferred delivery via FedEx, UPS between hours of 8:00am – 12:00pm noon or after 1:00pm). Note that the BSC is closed between hours of 12:00pm to 1:00pm for lunch.

TO: Elaine Robbins
Construction Solicitation Coordinator
University of North Texas System
Business Service Center
Woodhill Square
1112 Dallas Drive, Suite 4000
Denton, Texas 76205

BASE BID

Pursuant to and in compliance with the Contract Documents and any attachments thereto, including the Advertisement for Competitive Sealed Proposal and Instruction for Proposals, the Proposer hereby certifies that it has, carefully examined the Contract Documents entitled:

UNT New Dining Hall Retail Space Buildout
Prepared by: Kirksey Architecture

and the conditions affecting the Work, and being familiar with the site; and having made the necessary examinations, proposes to furnish all labor, materials, equipment, and services necessary to complete the Work in strict accordance with the Contract Documents for the above referenced project for the following sum (Not including bond cost), which is hereby designated as the Base Bid:

$
**ALTERNATE BIDS**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description of Alternate Bid:</th>
<th>Additive/Deductive</th>
<th>Bid Amount:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>BUILDER'S RISK INSURANCE</strong>-obtained by Owner and not provided by Contractor</td>
<td>☐ Additive</td>
<td>☐ Deductive</td>
</tr>
</tbody>
</table>

**PAYMENT TERMS**

The Owner shall be billed in accordance with Chapter 2251 of the Texas Government Code and payment shall be made no later than thirty (30) days following the later of (i) delivery of the goods or completion of the services and (ii) delivery of an invoice to Customer; and (c) interest, if any, on past due payments shall accrue and be paid in accordance with Chapter 2251 of the Texas Government Code. Payee must be in good standing, not indebted to the State of Texas, and current on all taxes owed to the State of Texas for payment to occur. Payment Applications and any required supporting documents must be presented to: University of North Texas System Facilities; 1155 Union Circle #311040, Denton, Texas 76203-5017.

a. Payment on any contract will be withheld from Proposer if Proposer is determined to be more than thirty (30) days delinquent for Child Support.
b. Successful Proposer shall be responsible for referencing the purchase order number(s) resulting from this proposal on any invoice(s), packing list(s), correspondence, etc. Invoicing must correlate to prices quoted either on a unit, hourly, etc. basis.
c. **DISQUALIFICATION:** Response is subject to disqualification if Proposer provides revisions and/or exclusions to the terms and conditions listed in this solicitation that the Owner is limited by law from accepting (i.e. offers with the laws of a State other than Texas), requirements for prepayment not defined in or allowed for in this Solicitation, limitations on remedies, any revision to stated terms and conditions of the Solicitation, etc.
d. Proposer agrees that any payments due under this contract may be applied towards any debt, including but not limited to delinquent taxes and child support that is owed to the State of Texas.

**SALES TAX**

Purchases made for the Owner’s use are exempt from the State Sales tax and Federal Excise tax. Do not include tax in response. Excise Tax Exemption Certificates are available upon request.

**INSURANCE**

The Proposer shall provide and maintain, until the work covered in this Contract is completed and accepted by the Owner, the minimum insurance coverage as stated in Division 00, Section 007000, *UGC*.

**TIME OF COMPLETION**

Consecutive Calendar Days needed to complete project: _________________ calendar days

**LIQUIDATED DAMAGES**

Liquidated damages will be in accordance with Division 00, Section 007000 “UGC”.

**BOND**

In accordance with Texas Government Code 2253, a Payment Bond is required for all public works agreements over $25,000.00 and a Performance Bond for all public works agreements over $100,000.00. It is estimated that this agreement will be over $100,000.00 so a Payment and Performance Bond is required. Please provide the amount as a total bond cost. The Owner will pay bonding costs to the awarded vendor as a pass through amount with proper documentation provided along with an invoice.

Payment and Performance Bond cost: $ ____________________________
ADDENDA

Receipt is hereby acknowledged of the following addenda to this RFCSP. (Initial, if applicable)

No. 1: _____  No. 2: _____  No. 3: _____  No. 4: _____  No. 5: _____  No. 6: _____


QUALIFICATIONS

Refer to Attachment A of this document. Qualifications must be submitted on the enclosed form and no other document will be accepted. Not providing qualifications on the provided form will be cause for disqualification.

An incomplete proposal or one having additional information or other modifications inscribed thereon, may be cause for rejections of the entire proposal. This proposal is valid and will be honored for a period of one hundred eighty (180) days following the proposal opening.

THIS SECTION MUST BE COMPLETED, SIGNED, AND RETURNED WITH RESPONDENT’S PROPOSAL. FAILURE TO SIGN AND RETURN THIS SECTION WILL RESULT IN DISQUALIFICATION OF YOUR FIRM.

1. By signature hereon, Respondent offers and agrees to furnish the products and/or services in compliance with all terms, conditions, requirements set forth per the RFP documents and contained herein.

2. By signature hereon, Respondent affirms that it has not given, nor intends to give at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor or service to a public servant in connection with the submitted proposal. Failure to sign hereon, or signing with a false statement, shall void the submitted proposal or any resulting contracts, and the Respondent shall be removed from all proposal lists at this Agency.

3. By signature hereon, a corporate Respondent certifies that it is not currently delinquent in the payment of any Franchise Taxes due under Chapter 171, Texas Tax Code, or that the corporation is exempt from the payment of such taxes, or that the corporation is an out-of-state corporation that is not subject to the Texas Franchise Tax, whichever is applicable. A false certification shall be deemed a material breach of contract and, at UNTS’s option, may result in cancellation of any resulting contract or purchase order.

4. By signature hereon, the Respondent hereby certifies that neither the Respondent nor the firm, corporation, partnership or institution represented by the Respondent, or anyone acting for such firm, corporation, or institution has violated the antitrust laws of this state, codified in Section 15.01, et. seq., Texas Business and Commerce Code, or the Federal antitrust laws, nor communicated directly or indirectly the proposal made to any competitor or any other person engaged in such line of business.

5. By signature hereon, Respondent certifies that all statements and information prepared and submitted in response to this solicitation are current, complete and accurate.

6. By signature hereon, Respondent certifies that the individual signing this document and the documents made part of the RFP is authorized to sign such documents on behalf of the company and to bind the company under any contract which may result from the submission of this proposal. Unsigned responses will not be considered under any circumstances.

7. By signature hereon, Respondent certifies that if a Texas address is shown as the address of the Respondent, Respondent qualifies as a Texas Resident Respondent as defined in Texas Administrative Code (TAC) Title 34. In the case of a tie, the award will be made in accordance with TAC, Title 34, amended. Check below preference claimed under TAC, Title 34, amended:

- Supplies, materials, or equipment produced in Texas/offered by Texas bidders
- Agricultural products produced or grown in Texas
- Agricultural products and services offered by Texas bidders
- USA produced supplies, materials, or equipment
- Products of persons with mental or physical disabilities
- Recycled, remanufactured, or environmentally sensitive products, including recycled steel products
- Energy efficient products
Rubberized asphalt paving material
Recycled motor oil and lubricants
Products produced at facilities located on formerly contaminated property
Products and services from economically depressed or blighted areas
Vendors that meet or exceed air quality standards

Consistent and continued tie Responses could cause rejection of offers by UNTS and/or investigation for antitrust violations.

8. By signature hereon, Respondent certifies it is a small business and/or minority/female owned business as defined by the State of Texas. Check status below:

☐ Historically Underutilized Business
☐ Small Business (House Bill 366, 64th Legislature)
☐ Minority/Female Owned Business (House Bill 2626, 73rd Legislature)
☐ Certified by Texas Department of Commerce
☐ Status not claimed

9. By signature hereon, Respondent certifies as follows:

"Under Section 231.006, Texas Family Code, the vendor or applicant certifies that the individual or business entity named in this 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."

"Under Section 2155.004, Texas Government Code, the vendor or applicant certifies that the individual or business entity named in this bid or contract is not ineligible to receive the specified contract and acknowledges that this contract may be terminated and payment withheld if this certification is inaccurate."

10. By signature hereon, Respondent certifies that no relationship, whether by relative, business associate, capital funding agreement or by any other such kinship, exist between Respondent and an employee of any UNTS component, or Respondent has not been an employee of any UNTS component within the immediate twelve (12) months prior to RFP response. All such disclosures will be subject to administrative review and approval prior to UNTS entering into any contract with Respondent.

11. Respondent certifies that they are in compliance with Section 669.003 of the Texas Government Code, relating to contracting with the executive head of a State agency. If Section 669.003 applies, respondent will complete the following information in order for the response to be evaluated:

Name of former Executive: ________________________________
Name of State Agency: ________________________________
Date of separation from State agency: ____________________
Position with Respondent: ___________________________ Date of employment with Respondent: ____________

12. By signature hereon, Respondent affirms that no compensation has been received for participation in the preparation of the specifications for this RFP. (ref. Section 2155.004, Texas Government Code).

13. Respondent represents and warrants that all articles and services quoted in response to this RFP meet or exceed the safety standards established and promulgated under the Federal Occupational Safety and Health Law (Public Law 91-596) and its regulations in effect or proposed as of the date of this solicitation.

14. Suspension, Debarment, and Terrorism: Respondent further certifies that the Respondent and its principals are eligible to participate in this transaction and have not been subjected to suspension, debarment, or similar ineligibility determined by any federal, state or local governmental entity and that Respondent is in compliance with the State of Texas statutes and rules relating to procurement and that Respondent is not listed on the federal government’s terrorism watch list as described in Executive Order 13224. Entities ineligible for federal procurement are listed at http://www.epis.gov.
15. By signature hereon, Respondent signifies his compliance with all federal laws and regulations pertaining to Equal Employment Opportunities and Affirmative Action.

16. By signature hereon, Respondent will comply with and agree to use E-Verify System in accordance with State of Texas Executive Order RP-80 throughout this project as appropriate.

17. Respondent affirmatively states that it does not boycott Israel, pursuant to Texas Gov’t Code, Section 2270.002. Additionally, respondent shall not engage in a boycott of Israel during the term of this Agreement.

18. Respondents should give Payee ID Number, full firm name, and address of Respondent below in the space provided. The Payee ID Number is the taxpayer number assigned and used by the Texas Comptroller of Public Accounts. If this number is not known, complete the Federal Employer’s Identification Number.

Complete the following:

Payee ID No. __________________________ If a Corporation
State of Incorporation: __________________________

FEI No. __________________________ Charter No: __________________________

Company Information: Submitted by:

(Company Name) (Authorized Signature)

(Street Address Line 1) (Printed Name/Title)

(Street Address Line 2) (Date)

(City, State, Zip Code) (Telephone Number)

(Facsimile Number)

(Email Address)
ATTACHMENT A

QUALIFICATIONS
RFCSP769-21-249969ER
UNT New Dining Hall Retail Space Buildout

ITEMS 1 THROUGH 5 TO BE SUBMITTED WITH PROPOSAL

Proposer’s Name: ________________________________________________________________

Point of Contact: _______________________________________________________________

Address: ______________________________________________________________________

City, State, Zip: __________________________________________________________________

Telephone No.: __________________________ Fax No. _________________________________

Email: __________________________________________________________________________

State Comptroller Vendor Identification Number: ______________________________________

1. GENERAL

A. Qualification information submitted shall be applicable only to the company entity or branch that will perform this Work.

B. Attach your Project Organization Chart and resumes of individuals who would be assigned to this project.

C. Proposed construction schedule (Bar chart acceptable).
2. HISTORY

A. Corporation ☐ Partnership ☐ Sole Proprietorship ☐ Joint Venture

State of Incorporation: __________________________

B. In continuous business since: ______________________

Remarks (if required):

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

C. Corporate Officers, Partners or Owners of Organization:

<table>
<thead>
<tr>
<th>Name</th>
<th>Branch Manager</th>
<th>Telephone Number</th>
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D. Check box(es) corresponding to the nature of your business:

☐ Large Business (100 or more employees)
☐ Small Business (fewer than 100 employees)
☐ HUB Business
☐ Other (Define) __________________________

E. Has your organization ever defaulted or failed to complete any work awarded?

☐ Yes ☐ No

If yes, stipulate where and why: ____________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

F. Has your organization ever paid liquidated damages or a penalty for failure to complete a contract on time?

☐ Yes ☐ No

If yes, stipulate where and why: ____________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
3. EXPERIENCE

A. Normally performs ____________ % of the work with own forces. List trades below:

________________________________________________________________________

________________________________________________________________________

B. Propose to perform ____________ % of the work for project with own forces. List trades below:

________________________________________________________________________

________________________________________________________________________

C. List all major projects of your organization has in-progress. If more space is needed attach pages to this form using format below identified by item and sub-item:

   i. Name, Location and Description of Project:__________________________________________________________

       ____________________________________________________________________________________________

       ____________________________________________________________________________________________

       ____________________________________________________________________________________________

       Contract Amount:________________________

       Percent Complete:________________________

       Project Completion Date:___________________

       Owner Reference Contact and Telephone Number:

       ____________________________________________________________________________________________

       ____________________________________________________________________________________________

       Architect Reference Contact and Telephone Number:

       ____________________________________________________________________________________________

       ____________________________________________________________________________________________

     ii. Name, Location and Description of Project:_____________________________________________________

         ____________________________________________________________________________________________

         ____________________________________________________________________________________________

         ____________________________________________________________________________________________

         Contract Amount:________________________

         Percent Complete:________________________

         Project Completion Date:___________________
Owner Reference Contact and Telephone Number:


Architect Reference Contact and Telephone Number:


iii. Name, Location and Description of Project:


Contract Amount:

Percent Complete:

Project Completion Date:

Owner Reference Contact and Telephone Number:


Architect Reference Contact and Telephone Number:


D. Total number and dollar amount of contracts currently in progress:

Number $ __________________________

E. Largest contract currently in-process: ________________________________

Anticipated date of completion: ________________________________

F. Volume of work completed over last 5 years: (Through 12/31)

<table>
<thead>
<tr>
<th>Year</th>
<th>$</th>
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G. List three (3) major projects of similar scope your organization has completed in the last five (5) years with completion date and references. Other projects of particular significance may also be listed.

i. Name, Location and Description of Project:  

______________________________________________________________________________________________  

______________________________________________________________________________________________  

______________________________________________________________________________________________  

Contract Amount:__________________________  
Percent Complete:_________________________  
Project Completion Date:____________________  

Owner Reference Contact and Telephone Number:

Name____________________________________  Telephone Number__________________________

Architect Reference Contract and Telephone Number:

Name____________________________________  Telephone Number__________________________

ii. Name, Location and Description of Project:  

______________________________________________________________________________________________  

______________________________________________________________________________________________  

______________________________________________________________________________________________  

Contract Amount:__________________________  
Percent Complete:_________________________  
Project Completion Date:____________________  

Owner Reference Contact and Telephone Number:

Name____________________________________  Telephone Number__________________________

Architect Reference Contract and Telephone Number:

Name____________________________________  Telephone Number__________________________
### iii. Name, Location and Description of Project:

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<tr>
<th>Name</th>
<th>Telephone Number</th>
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</table>

Contract Amount: ____________________________

Percent Complete: __________

Project Completion Date: ______________________

Owner Reference Contact and Telephone Number:

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<thead>
<tr>
<th>Name</th>
<th>Telephone Number</th>
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</table>

Architect Reference Contract and Telephone Number:

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<th>Name</th>
<th>Telephone Number</th>
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</table>

### iv. Name, Location and Description of Project:

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<tr>
<th>Name</th>
<th>Telephone Number</th>
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</table>

Contract Amount: ____________________________

Percent Complete: __________

Project Completion Date: ______________________

Owner Reference Contact and Telephone Number:

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<th>Name</th>
<th>Telephone Number</th>
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Architect Reference Contract and Telephone Number:

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<th>Name</th>
<th>Telephone Number</th>
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</table>
H. Has your organization had any claims and/or litigations in the last 5 years?

If yes, attach a list with project name, date or project, owner, owner's contact person with telephone number and summary explanation.
4. SAFETY PROGRAM

A. List your organization’s Workers Compensation Experience Modification Rate (EMR) for the last three (3) years, as obtained from your insurance agent.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>EMR</th>
</tr>
</thead>
</table>

B. Complete matrix for the three (3) past years, as obtained from OSHA N. 200 Log:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of injuries and illness</th>
<th>Number of lost time accidents</th>
<th>Number of recordable cases</th>
<th>Number of fatalities</th>
</tr>
</thead>
</table>

Please provide your SIC Code ______________

C. Are regular project safety meetings held for Field Supervisor(s)?

☐ Yes  ☐ No

If yes, frequency:

☐ Weekly  ☐ Bi-monthly  ☐ Monthly  ☐ As Needed

D. Are project safety inspections conducted?  ☐ Yes  ☐ No

If yes, who performs inspection?    How often?

__________________________________________  ______________________

E. Does organization have a written safety program?  ☐ Yes  ☐ No

If yes, provide a copy. It will become a compliance document upon contract award.

F. Does your organization have a safety orientation program for new employees?  ☐ Yes  ☐ No

For employees promoted to Field Supervisors?  ☐ Yes  ☐ No

If yes, does your Supervisor Safety Program include instructions on the following:

Safety work practices  Yes  ☐
Tool box safety meetings  ☐
First aid procedures  ☐
Accident investigation  ☐
Fire protection  ☐
New worker’s orientation  ☐
5. **FINANCIAL**

A. Attach an audited Financial Statement, including a profit and loss statement and other supporting schedules. If the last audited statement is over twelve (12) months old, include the most current unaudited statement.

B. Surety Company: ________________________________
   Agent: ________________________________
   Name of Contact: ________________ Telephone No. ________________

C. Bonding Capacity: ________________________________
   Limit per project: ________________________________
   Unencumbered bonding capacity: ________________________________

D. Trade References (Additional references may be included as attached sheets.)
   
   i. Organization: ________________________________
      Agent: ________________________________
      Name of Contract: ________________________________ Telephone No. ________________
   
   ii. Organization: ________________________________
       Agent: ________________________________
       Name of Contract: ________________________________ Telephone No. ________________
   
   iii. Organization: ________________________________
        Agent: ________________________________
        Name of Contract: ________________________________ Telephone No. ________________
GENERAL CONSTRUCTION AGREEMENT
GENERAL CONSTRUCTION AGREEMENT
(For Use with Competitive Sealed Proposals)

This Agreement is made and entered into by and between University of North Texas {System or Institution Name} ("Owner"), and by {Firm Name} ("Contractor"), duly authorized by the laws of the State of Texas to act as contractor for construction, rehabilitation, alteration, or repair services. The capitalized term “Party” refers to either Owner or Contractor individually and the term “Parties” refers to Owner and Contractor collectively. The effective date (“Effective Date”) of this Agreement shall be the date of last signature by the parties hereto.

ARTICLE 1
PROJECT

1.1 Owner does hereby engage Contractor and Contractor does hereby agree to provide all labor, materials, equipment, and services necessary to complete the Work, all of which shall be provided in full accord with and reasonably inferable from the Contract Documents to construct the {Project Name} ("Project"), on the {Campus}, to be completed in accordance with the requirements herein, and generally described as follows:

{General Description of the Project}

1.2 Contractor has overall responsibility for and shall furnish all materials, equipment, tools, and labor as necessary or reasonably inferable to complete the Work, or any phase of the Work, in accordance with Owner’s requirements and the terms of the Contract Documents.

ARTICLE 2
CONTRACT DOCUMENTS

2.1 Owner, through its Design Professional, shall provide all architectural and engineering design services necessary for the completion of the Work. The Drawings, Specifications, and addenda have been prepared for Owner by {Architect/Engineer} ("Design Professional").

2.2 The Contract Documents consist of:

2.2.1 This Agreement and all exhibits and attachments listed, contained or referenced in this Agreement;

2.2.2 The Uniform General Conditions for Construction and Design Contracts for the University of North Texas System ("Uniform General Conditions" or "UGC");

2.2.3 Supplementary General Conditions or Special Conditions, if any;

2.2.4 Owner’s Specifications;

2.2.5 All Addenda issued prior to the Effective Date of this Agreement;

2.2.6 All Change Orders issued after the Effective Date of this Agreement;

2.2.7 The Drawings, Specifications, details and other documents developed by Design Professional to describe the Project and accepted by Owner;

2.2.8 The Drawings and Specifications developed or prepared by Owner’s other consultants, if any, and accepted by Owner; and
2.2.9 The Historically Underutilized Business (HUB) subcontracting plan submitted or amended by Contractor and approved by Owner for this Project.

2.3 The Contract Documents form the entire and integrated Contract between Owner and Contractor and supersede all prior negotiations, representations or agreements, written or oral.

2.4 To the extent the terms of this Agreement conflict with the Uniform General Conditions and/or the Supplemental Conditions, the terms of this Agreement will control.

2.5 If there is an irreconcilable conflict between or among the various documents that make up the Contract Documents, the interpretation that provides for the higher quality of material and/or workmanship will prevail over all other interpretations.

**ARTICLE 3 DEFINITIONS**

3.1 Terms, words, and phrases used in the Contract Documents shall have the meanings given in the Uniform General Conditions.

3.2 The following terms, words, and phrases used in the Contract Documents shall have the following meanings, and if more specific than the definition given in the Uniform General Condition, the more specific given in this Agreement shall control.

3.2.1 “Baseline Schedule” means the initial time schedule prepared by Contractor for Owner’s information and acceptance that conveys Contractor’s and Subcontractors’ activities (including coordination and review activities required in the Contract Documents to be performed by the Design Professional and Owner), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule shall clearly demonstrate the longest path of activities, critical activities durations, and necessary predecessor conditions that drive the end date of the schedule. The accepted Construction Baseline Schedule shall not change.

3.2.2 “Design Professional” means licensed professionals, or firms employing such licensed professionals, engaged by Owner as independent architects or engineers for design of all or a portion of the Project and to prepare Drawings and Specifications for the construction of the Project. More than one such professional or firm may be employed by Owner, and all such professionals or firms, regardless of number, are referred to in the singular herein.

3.2.3 “Longest Path” means the sequence of directly related activities that comprise the longest continuous chain of activities from the start of the first activity to the finish of the last activity. Each activity in the Longest Path is critical and directly related in that it prevents its successor from being scheduled earlier than it is. For this Project, “Longest Path” shall also include Ten Percent (10%) Total Float and Weather Days.

3.2.4 “Subcontractor” means a person or entity who has an agreement with Contractor to perform any portion of the Work. The term Subcontractor does not include the Design Professional or any person or entity hired directly by Owner.

3.2.5 “Total Float” shall refer to the number of days all activities on the Longest Path can be delayed without delaying the Substantial Completion Date.

3.2.6 “Work” means the provision of all services, labor, materials, supplies, and equipment that are required of Contractor to complete the Project in strict accordance with the requirements of the Agreement and the Construction Documents. Work includes, but is not limited to, the construction services, additional work required by Change Orders, and any other work reasonably inferable from the Construction Documents. The term
“reasonably inferable” takes into consideration the understanding of the parties that some details necessary for completion of the Work may not be shown on the Drawings or included in the Specifications, but they are a requirement of the Work if they are a usual and customary component of the Work or otherwise necessary for complete installation and operation of the Work.

3.2.7 “Work Progress Schedule” (“WPS”) means the continually updated time schedule prepared by Contractor that coordinates and integrates activities of the Project, including Contractor’s services, Design Professional’s services, the work of other consultants, suppliers, and Owner’s activities with the anticipated construction schedules for other contractors. The WPS accurately indicates all necessary and appropriate revisions including a longest path impact analysis, as required by the conditions of the Work and the Project while maintaining a concise comparison to the Baseline Schedule.

ARTICLE 4
CONTRACTOR’S RESPONSIBILITIES

4.1 Contractor's responsibilities include but are not limited to supervision, furnishing labor, materials, equipment, employment of and responsibility for subcontractors, payment of taxes where applicable, patent fees, royalties, approval fees, license fees, permit fees, filing fees, registration fees, and other governmental charges.

4.2 Contractor represents that it is an independent contractor and that it is familiar with the type of Work it is undertaking. Contractor shall furnish construction administration and management services and use Contractor's diligent efforts to perform the Work in an expeditious manner consistent with the Contract Documents. Contractor will cause all persons connected with Contractor directly in charge of the Work to be duly registered and/or licensed under all applicable laws.

4.3 Neither Contractor nor any of its agents or employees shall act on behalf of or in the name of Owner except as provided in this Agreement or unless authorized in writing by Owner's Representative.

4.4 Contractor shall be responsible for the supervision and coordination of the Work, including the construction means, methods, techniques, sequences, procedures, safety provisions, precautions, and programs utilized, unless the Contract Documents give other specific instructions. In such case, Contractor shall not be liable to Owner for damages resulting from compliance with such instructions unless Contractor recognized and failed to timely report to Owner any error, inconsistency, omission, or unsafe practice that it discovered in the specified construction means, methods, techniques, sequences, procedures, safety provisions, precautions, or programs.

4.5 Contractor shall perform Work only within locations allowed by the Contract Documents, applicable laws and regulations, and applicable permits. Laws and regulations include federal, state, and local laws, ordinances, codes, rules, and regulations applicable to the Work with which the Constructor must comply that are enacted as of the Agreement date.

4.6 Owner may perform work at the site directly or by others. Contractor and Owner shall coordinate the activities of all forces at the site and agree upon fair and reasonable schedules and operational procedures for site activities.

4.7 Contractor shall: (a) proceed with the Work in a manner that does not hinder, delay, or interfere with the work of Owner or others or cause the work of Owner or others to become defective; (b) afford Owner or others reasonable access for introduction and storage of their materials and equipment and performance of their activities; and (c) coordinate Contractor's Work with the work of Owner and others.
4.8 Before proceeding with any portion of the Work affected by the construction or operations of Owner or others, Contractor shall give Owner written notification within forty-eight (48) hours of any defects Contractor discovers in Owner's or other's performance or work, which will prevent the proper execution of the Work. Contractor's obligations in this subsection do not create a responsibility for the performance or work of Owner or others, but are for the purpose of facilitating the Work. If Contractor does not notify Owner of defects interfering with the performance of the Work, Contractor acknowledges that the performance or work of Owner or others is not defective and is acceptable for the proper execution of the Work. Following receipt of written notice from Contractor of defects, Owner shall promptly inform Contractor what action, if any, Contractor shall take with regard to the defects.

4.9 Prior to commencing the Work, Contractor shall examine and compare the Drawings and Specifications with information furnished by Owner that are Contract Documents, relevant field measurements made by Contractor, and any visible conditions at the site affecting the Work. During the visit to the site, Contractor shall inspect the existing facilities, systems and conditions to ensure an accurate understanding of the existing conditions as required.

4.10 Should Contractor discover any discrepancies, errors, omissions, or inconsistencies in the Contract Documents, Contractor shall report them to Owner within forty-eight (48) hours of discovery. It is recognized, however, that Contractor is not acting in the capacity of a licensed design professional, and that Contractor's examination is to facilitate construction and does not create an affirmative responsibility to detect discrepancies, errors, omissions, or inconsistencies or to ascertain compliance with applicable laws and regulations, including building codes. Following receipt of written notice from Contractor of defects, Owner shall promptly inform Contractor what action, if any, Contractor shall take with regard to the defects.

4.10.1 Contractor shall have no liability for discrepancies, errors, omissions, or inconsistencies discovered under this section unless Contractor fails to promptly report a discovered or apparent discrepancy, error, omission, or inconsistency to Owner. This does not relieve Contractor of responsibility for its own discrepancies, errors, inconsistencies, or omissions.

4.11 Contractor shall provide competent supervision for the performance of the Work. Before commencing the Work, Contractor shall notify Owner in writing of the name and qualifications of its proposed superintendent(s) and project manager, so Owner may review the individual's qualifications. If, for reasonable cause, Owner refuses to approve the individual, or withdraws its approval after giving it, Contractor shall name a different superintendent or project manager for Owner's review. Any disapproved superintendent shall not perform in that capacity thereafter at the site. Contractor's superintendent(s) and project manager shall possess full authority to receive instructions from Owner and to act on those instructions. If Contractor changes its superintendent(s) or project manager or their authority, Contractor shall immediately notify Owner in writing.

4.12 Contractor shall be responsible to Owner for acts or omissions of parties or entities performing portions of the Work for or on behalf of Contractor or any of its Subcontractors.

4.13 Contractor shall permit only qualified persons to perform the Work. Contractor shall enforce safety procedures, strict discipline, and good order among persons performing the Work.

4.14 Contractor shall submit to Owner and the Design Professional all shop drawings, samples, product data, and similar submittals required by the Contract Documents for review and approval. Submittals shall be submitted in accordance with the Uniform General Conditions. Contractor shall be responsible for the accuracy and conformity of its submittals to the Contract Documents requirements.
4.15 Contractor acknowledges that it has visited, or has had the opportunity to visit, the site to visually inspect the general and local conditions of the facilities, systems and conditions to ensure an accurate understanding of the existing conditions which could affect the Work.

4.16 The Work shall be executed in accordance with the Contract Documents and Contractor agrees that (a) it will use its best efforts to perform the Work in a good and workmanlike manner and in accordance with the highest standards of Contractor’s profession or business, and (b) all the Work to be performed will be of the quality that prevails among similar businesses of superior knowledge and skill engaged in providing similar services. All materials used in the Work shall be furnished in sufficient quantities to facilitate the proper and expeditious execution of the Work.

4.17 If the Work includes installation of materials or equipment furnished by Owner or others, it shall be the responsibility of Contractor to examine the items so provided and thereupon handle, store, and install the items, unless otherwise provided in the Contract Documents, with such skill as to provide a satisfactory and proper installation. Loss or damage due to acts or omissions of Contractor shall be the responsibility of Contractor and may be deducted from any amounts due or to become due Contractor. Any defects discovered in such materials or equipment shall be reported at once to Owner. Following receipt of written notice from Contractor of defects, Owner shall promptly inform Contractor what action, if any, Contractor shall take with regard to the defects.

4.18 Contractor shall have overall responsibility for safety precautions and programs in the performance of the Work. However, such obligation does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work or for compliance with applicable laws and regulations.

4.18.1 Contractor shall seek to avoid injury, loss, or damage to persons or property by taking reasonable steps to protect: (a) its employees and other persons at the site; (b) materials and equipment stored at onsite or offsite locations for use in the Work; and (c) property located at the site and adjacent to Work areas, whether or not the property is part of the site.

4.18.2 Contractor’s site safety representative shall have a duty to prevent accidents. The safety representative shall perform their duty in accordance with the Uniform General Conditions.

4.18.3 If Owner deems any part of the Work or site unsafe, Owner, without assuming responsibility for Contractor’s safety program, may require Contractor to stop performance of the Work or take corrective measures satisfactory to Owner, or both. If Contractor does not adopt corrective measures, Owner may perform them and deduct their cost from the Contract Price. If Owner determines that a particular person does not follow safety procedures, or is unfit or unskilled for the assigned Work, Contractor shall immediately reassign the person upon receipt of Owner’s written notice to do so. Contractor agrees to make no claim for damages, for an increase in the Contract Price or for a change in the Contract Time based on Contractor’s compliance with Owner’s reasonable request.

4.19 If the conditions encountered at the site are: (a) subsurface or other physical conditions materially different from those indicated in the Contract Documents; or (b) unusual and unknown physical conditions materially different from conditions ordinarily encountered and generally recognized as inherent in Work provided for in the Contract Documents, then Contractor shall stop affected Work after the condition is first observed and give written notice of the condition to Owner and the Design Professional within forty-eight (48) hours.

4.20 Contractor shall regularly remove debris and waste materials at the site resulting from the Work. Prior to discontinuing Work in an area, Contractor shall clean the area and remove all rubbish and its construction equipment, tools, machinery, waste, and surplus materials. Contractor shall minimize and confine dust and debris resulting from construction activities. At the completion of
the Work, Contractor shall remove from the site all construction equipment, tools, surplus materials, waste materials, and debris.

4.20.1 If Contractor fails to commence compliance with cleanup duties within two (2) Business Days after written notification from Owner of non-compliance, Owner may implement appropriate cleanup measures without further notice and shall deduct the reasonable costs from any amounts due or to become due Contractor in the next payment period.

4.21 Contractor shall facilitate the access of Owner, Design Professional, and others to Work in progress.

4.22 Contractor shall comply with all applicable laws and regulations at its own costs. Contractor shall be liable to Owner for all loss, cost, or expense attributable to any acts or omissions by Contractor, its employees, subcontractors, and agents for failure to comply with applicable laws and regulations, including fines, penalties, or corrective measures.

4.23 Contractor warrants that all materials and equipment shall be new unless otherwise specified, of good quality, in conformance with the Contract Documents, and free from defective workmanship and materials. Contractor shall furnish satisfactory evidence of the quality and type of materials and equipment furnished. Contractor further warrants that the Work shall be free from material defects not intrinsic in the design or materials required in the Contract Documents. Contractor's warranty shall commence on the Date of Substantial Completion of the Work.

4.23.1 Contractor shall obtain from its Subcontractors and Material Suppliers any special or extended warranties required by the Contract Documents. Contractor's liability for such warranties shall be limited to a one-year period. After that period, Contractor shall provide reasonable assistance to Owner in enforcing the obligations of Subcontractors or Material Suppliers for such extended warranties.

4.23.2 If, prior to Substantial Completion and within one year after the date of Substantial Completion of the Work, any Work not complying with the contract requirements (Defective Work) is found, Owner shall promptly notify Contractor in writing. Unless Owner provides written acceptance of the condition, Contractor shall promptly correct the Defective Work at its own cost and time and bear the expense of additional Work required for correction of any Defective Work for which it is responsible.

4.23.3 With respect to any portion of Work first performed after Substantial Completion, the one-year period shall be extended by the period between Substantial Completion and the actual performance of the later Work. Correction periods shall not be extended by corrective work performed by Contractor.

4.23.4 If Contractor fails to correct Defective Work within a reasonable time after receipt of written notice from Owner prior to final payment, Owner may correct it in accordance with Owner's right to carry out the Work. In such case, an appropriate Change Order shall be issued deducting the cost of correcting the Defective Work from payments then or thereafter due Contractor. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor shall pay the difference to Owner.

4.23.5 If Contractor's correction or removal of Defective Work causes damage to or destroys other completed or partially completed Work or existing buildings, Contractor shall be responsible for the cost of correcting the destroyed or damaged property.

ARTICLE 5
SUBCONTRACTS

5.1 With the prior written approval of Owner, Contractor may subcontract such services as Contractor deems necessary to meet its obligations under this Agreement. Subcontractors shall be qualified
and experienced in the type of work they will be performing. Owner shall have the right to reject any subcontractor but such right shall not relieve the responsibility of Contractor for his work and the work of the subcontractors. Contractor expressly assumes such responsibility and liability.

5.2 Contractor shall be responsible for the management of the Subcontractors in the performance of the Work.

5.3 If this Agreement is terminated, each subcontract agreement shall be assigned by Contractor to Owner, subject to the prior rights of any surety, provided that: (a) this Agreement is terminated by Owner pursuant to Section 11.1; and (b) Owner accepts such assignment, after termination by notifying the Subcontractor and Contractor in writing, and assumes all rights and obligations of Contractor pursuant to each subcontract agreement.

5.4 Contractor agrees to bind every Subcontractor and material supplier (and require every Subcontractor to so bind its sub-subcontractors and material suppliers) to all provisions of this Agreement as they apply to the Subcontractors’ or material Suppliers’ portions of the Work.

5.5 Contractor shall comply with the HUB Program as define by Tex. Gov’t Code, Chapter 2161. Failure to comply with the HUB Program may constitute a material breach of this Contract as determined by Owner’s sole discretion.

5.6 Contractor agrees to comply with the established HUB Subcontracting Approach and shall make no changes to the HUB Subcontracting Approach without the prior written approval of Owner. Construction Manager will work with the Business Support Services HUB Coordinator to develop the HUB Subcontracting Plan (HSP). Further details concerning the HSP are located within the Uniform General Conditions.

ARTICLE 6
OWNER’S RESPONSIBILITIES

6.1 Owner shall provide Contractor with reasonable access to the site to assist Contractor in its performance of all tasks reasonably necessary for the completion of Work.

6.2 Owner hereby expressly reserves the right from time to time to designate by notice to Contractor one or more representatives to act partially or wholly for Owner in connection with the performance of Owner’s obligations hereunder. Contractor shall act only upon instructions from such representatives unless otherwise specifically notified to the contrary.

6.3 Owner’s representative shall: (a) be fully acquainted with the Project, Work, and site; (b) agree to furnish the information and Work required of Owner in a timely manner; and (c) have the authority to bind Owner (to the extent of their authority) in all matters requiring Owner's approval or authorization. If Owner changes its representative, Owner shall promptly notify Contractor in writing.

6.4 Owner will furnish the site plan to document existing conditions to the extent requested by Contractor and as reasonably necessary for the completion of Contractor’s Work.

6.5 Owner shall examine, or cause its representative(s) to examine documents submitted by Contractor and render decisions pertaining thereto promptly or within a reasonable time to avoid unreasonable delay in the progress of Contractor’s Work. Review and approval of a document by Owner shall not waive the contractual responsibility or liability of Contractor.

6.6 Owner shall furnish information required as expeditiously as necessary for the orderly progress of Contractor’s Work.

6.7 Except for those permits and fees related to the Work which are the responsibility of Contractor, Owner shall secure and pay for all other permits, approvals, easements, assessments, and fees
required for the development, construction, use or occupancy of permanent structures or for permanent changes in existing facilities, including the building permit.

ARTICLE 7
SCHEDULE, COMMENCEMENT, AND COMPLETION

7.1 Owner shall provide a Notice to Proceed in which a date for commencement of the Work to be performed shall be stated. Contractor shall achieve Substantial Completion of the work no later than \{Written Number\} (\#) calendar days from the date of the Notice to Proceed, subject to extension only by approved Change Orders. Final Completion, including correction of deficiencies, shall be achieved no later than thirty (30) calendar days from the date of the Substantial Completion. Contractor understands that the Substantial Completion and Final Completion dates shall not be extended regardless of weather, strikes, or for any other reason unless Change Orders so approve. The time set forth for completion of the Work is an essential element of this Agreement.

7.1.1 Time is of the essence for this Agreement and the Contract Documents.

7.1.2 Unless instructed by Owner in writing, Contractor shall not knowingly commence the Work before the effective date of insurance to be provided by Contractor.

7.2 Schedule.

7.2.1 Contractor shall submit for review and approval a Baseline Schedule to Owner and Design Professional when submitting the response to Request for Competitive Sealed Proposal (RFCSP). The Baseline Schedule shall indicate the dates for starting and completing the various aspects required to complete the work and shall utilize the Longest Path Method with fully editable logic. The schedule shall include mobilization, procurement, installation, testing, inspection, delivery of Close-out Documents, and acceptance of all Work. This Baseline Schedule shall become the comparison to the actual conditions throughout the Contract duration and become a part of the Work Progress Schedule (WPS).

7.2.1.1 A Baseline Schedule that does not have at least the minimum amount of Total Float at submission will result in the Contractor forfeiting all claims to WPS extensions and/or delays as a result of contract changes and/or excusable delays as described in the UGCs.

7.2.1.2 In accordance with the UGCs, the WPS shall include at least ten percent (10%) Total Float and weather days from the effective date of Notice to Proceed for Construction Services to Substantial Completion Date.

7.2.1.3 Total Float shall not be shown as a single activity, but rather the results of the relationship between the early and late finish dates or early and late start dates of each Activity. The allocation of project float shall be determined by the Project Team as conditions warrant.

7.2.2 As construction proceeds, Contractor shall update and submit the WPS with the Owner, Architect, and Contractor (OAC) meeting minutes. The WPS is to indicate detailed listing for all activity sequences, durations, or milestone dates for activities of the Project, including, without limitation:

7.2.2.1 commencement, milestones, and completion dates for bidding/proposals phase, construction phase, and project stages;

7.2.2.2 times of commencement and completion, duration, and allocation of labor and materials for each Subcontractor;
7.2.3 Other detailed schedule activities as directed by Owner including, but not limited to, Owner-managed work under separate contracts such as equipment, furniture and furnishings, telephones, project security, property protection, life-safety systems, integration with central campus monitoring systems, information and instructional technology, data-transmission systems, and computer technology systems;

7.2.4 A recommended schedule for Owner’s purchase of materials and equipment requiring long lead-time procurement, delivery dates of products requiring long lead time procurement, and methods to expedite and coordinate delivery of long lead-time procurements including coordination of the Schedule;

7.2.5 Owner's occupancy requirements and estimated date of Substantial Completion of the Project;

7.2.6 Potential and actual variances between scheduled and probable completion dates;

7.2.7 Review of schedules for Work not started or incomplete and recommendation to Owner of adjustments in the schedules to conform to the probable completion dates;

7.2.8 Summary reports to Owner of each schedule update and documentation of all changes in construction schedules; and

7.2.9 Evaluation of Subcontractor’s personnel, equipment, and availability of supplies and materials, with respect to each Subcontractor’s ability to meet the Schedule and Recommendation to Owner when any subcontract requirements are not met, or appear unlikely to be met.

7.3 During OAC meeting, Contractor shall review progress since last meeting with the Owner and Design Professional; determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor’s WPS; determine how construction behind schedule will be expedited; secure commitments from parties involved to do so; discuss whether schedule revisions are required to ensure the current and subsequent activities will be completed within the Contract Time; and review WPS for next period.

7.4 In addition to attending regularly scheduled OAC Project progress meetings, Contractor shall schedule, direct and attend interim progress meetings (i.e., commissioning meetings, coordination meetings, pre-installation meetings) with other members of the Project Team as required to maintain Project progress. Contractor shall record and distribute the minutes of each meeting to each Project Team member. The minutes shall identify critical activities that require action and the dates by which each activity must be completed.

7.5 If WPS updates indicate the Longest Path contained in prior WPS will not be met, Contractor shall notify the Owner in writing within forty-eight (48) hours and make recommendations to Owner. Should the item be critical in nature, Contractor shall have a follow-up discussion with Owner.

7.6 Contractor concurrently with making revisions to schedule shall prepare tabulated reports showing the following:

7.6.1 Identification of activities that have changed
7.2.7 Contractor shall provide the necessary Longest Path schedule control with a goal to attain the Substantial Completion Date of the Project, so that Owner can occupy and utilize the entire Project facilities on such date as well as a Punch List and Final Completion date;

7.2.7.1 Punch List and Final Completion: The Longest Path schedule control shall include not more than thirty (30) days or an agreed to timeframe approved by Owner for punch list and final completion.

7.2.8 Contractor shall coordinate preparation of the Schedule of Values with preparation of WPS.

7.2.9 Contractor shall create and maintain the WPS in a format acceptable to Owner (the license and training for which shall be at Contractor’s sole expense).

7.2.10 Contractor shall notify Owner within forty-eight (48) hours should a periodic update to the WPS indicates the Work is fourteen (14) or more calendar days behind the current approved WPS. Contractor shall submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the WPS and indicate changes to working hours, working days, crew sizes, and equipment required for compliance, and date by which recovery will be accomplished.

7.2.10.1 Owner’s Notice Not to Accelerate to Contractor shall not be considered acceleration by Owner and Owner shall not be responsible for any increased costs incurred by Contractor.

7.2.11 Contractor shall refer to the Uniform General Conditions for schedule extension and delay processes.

7.2.12 Owner may determine the sequence in which the Work shall be performed, provided it does not unreasonably interfere with the WPS. Owner may require Contractor to make reasonable changes in the sequence at any time during the performance of the Work in order to facilitate the performance of work by Owner or others. To the extent such changes increase Contractor’s costs or time, the Contract Price and Contract Time shall be equitably adjusted.

ARTICLE 8
COMPENSATION AND PAYMENT

8.1 In full consideration of Contractor’s performance of the Work and services under this Agreement, Owner shall pay to Contractor, subject to additions and deductions provided herein, the sum of {Amount} and No/100 Dollars (#{.00}), in periodic progress payments as hereinafter provided.

The Contract Sum is the total of the following:
<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Bid</td>
<td>$(Amount)</td>
</tr>
<tr>
<td>Alternate 1 -</td>
<td>$(Amount)</td>
</tr>
<tr>
<td>Alternate 2 -</td>
<td>$(Amount)</td>
</tr>
<tr>
<td>Alternate 3 -</td>
<td>$(Amount)</td>
</tr>
<tr>
<td>Payments and Performance Bonds</td>
<td>$(Amount)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$(Amount)</td>
</tr>
</tbody>
</table>

8.1 On a monthly basis and subject to procedures set forth in the Uniform General Conditions, Contractor shall submit an Application for Payment, in accordance with Division 01 Specifications. Supporting documentation should include, without limitation: a certified statement as to the Work completed and current schedule of values; a project-to-date job cost report and a current period job cost report; a breakdown of materials and labor; supporting subcontractor invoices and sworn statements and waivers of lien for all amounts paid to Contractor for materials, labor, equipment, and other costs; and copies of third-party invoices, receipts, and other third-party supporting documentation.

8.2 Based on the Application for Payment, Owner shall make a periodic progress payment to Contractor for the cost of labor, materials, and equipment incurred by Contractor in relation to the Work during the previous month, except that the percentage of the total amount paid shall not exceed the percentage amount of the Work that has been completed as determined in the reasonable judgment of Owner. Upon verification of costs incurred and percentage of Work completed, Owner will make payment to Contractor within thirty (30) working days or will notify Contractor of any objection to the invoiced amount.

8.3 Owner shall have the right to withhold from payments due Contractor such sums as are necessary to protect Owner against any loss or damage which may result from negligence by Contractor or failure of Contractor to perform Contractor's obligations under this Agreement and as set forth in the Uniform General Conditions.

8.4 The final request for payment shall not be made until Contractor delivers to Owner a complete release of all liens arising out of this Agreement and an affidavit that so far as Contractor has knowledge or information, the release includes and covers all materials and Work over which Contractor has control for which a lien could be filed, but Contractor may, if any agent or consultant refuses to furnish a release in full, furnish a bond satisfactory to Owner to indemnify Owner against any lien. If any lien remains unsatisfied after all payments are made, Contractor shall refund to Owner all moneys Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys’ fees, and Owner shall have all remedies at law and in equity.

8.5 In addition to the procedures contained in the Uniform General Conditions, Owner shall have no obligation to make Final Payment until a final accounting of the Work has been submitted by Contractor and has been verified by Owner or Owner’s representatives. The aggregate total of payments to Contractor shall not exceed the total of the actual Work as verified by Owner or Owner’s representative from Contractor’s final accounting, as certified for payment in accordance with the Agreement. If payments made to Contractor exceed that which is due and owing pursuant to this Article, then Contractor shall promptly refund such excess to Owner.

8.6 Nothing contained herein shall require Owner to pay Contractor an aggregate amount exceeding the Agreement or to make payment if in Owner’s belief the cost to complete the Work would exceed the Agreement less previous payments to Contractor. Any provision to the contrary notwithstanding, Owner shall not be obligated to make any payment (whether a periodic progress payment or Final Payment) to Contractor hereunder if any one or more of the following conditions precedent exist:
8.6.1 Contractor is in breach or default under this Agreement;

8.6.2 Any part of such payment is attributable to services which are not performed in accordance with this Agreement; provided, however, such payment shall be made as to the part thereof attributable to services which were performed in accordance with this Agreement;

8.6.3 Contractor has failed to make payments promptly to consultants or other third parties used in connection with the services for which Owner has made payment to Contractor;

8.6.4 If Owner, in its good faith judgment, determines that the portion of the compensation then remaining unpaid will not be sufficient to complete the services in accordance with this Agreement, no additional payments will be due Contractor hereunder unless and until Contractor, at Contractor's sole cost, performs a sufficient portion of the remaining services so that such portion of the compensation then remaining unpaid is determined by Owner to be sufficient to so complete the then remaining services; or

8.6.5 To the extent Liquidated Damages or actual damages are imposed by Owner for failure of Contractor to complete the Work within the Contract Time.

8.7 No partial payment made hereunder shall be, or shall be construed to be, final acceptance or approval of that part of the services to which such partial payment relates, or a release of Contractor of any Contractor's obligations hereunder or liabilities with respect to such services.

8.8 Contractor shall promptly pay all bills validly due and owing for labor and material performed and furnished by others in connection with the performance of the construction of the Work.

8.9 Owner shall have the right to verify and audit the details set forth in Contractor's billings, certificates, accountings, cost data, and statements, either before or after payment therefore, by: (a) inspecting the books and records of Contractor during normal business hours; (b) examining any reports with respect to this Project; (c) interviewing Contractor's business employees; (d) visiting the Project site; and (e) other reasonable action.

8.10 The acceptance by Contractor or Contractor's successors of Final Payment under this Agreement, shall constitute a full and complete release of Owner from any and all claims, demands, and causes of action whatsoever which Contractor or Contractor's successors have or may have against Owner under the provisions of this Agreement except those previously made in writing and identified by Contractor as unsettled at the time of the final request for payment.

8.11 Owner shall be billed in accordance with Chapter 2251 of the Texas Government Code and interest, if any, on past due payments shall accrue and be paid in accordance with Chapter 2251 of the Texas Government Code.

8.12 All invoices submitted for payment must include a HUB Progress Assessment Report (PAR). The PAR should document compliance with the HUB Plan.

ARTICLE 9
BONDS

9.1 Prior to commencing work, Contractor shall provide performance and payment bonds in accordance with the requirements set forth in the Uniform General Conditions. The penal sum of the payment and performance bonds shall be for 100% of the Contract Sum. Any increase in the Contract Price shall require a rider to the Bonds increasing penal sums accordingly. Contractor shall endeavor to keep its surety advised of changes potentially impacting the Contract Time and Contract Price. Owner will pay Contractor the bonding costs as a pass through amount not to exceed {Amount} ($#).00 with proper documentation provided along with an Application for Payment. No retainage is to be withheld with respect to the cost of the required bonds.
9.2 Contractor shall not cause or allow any of its bonds to be canceled nor permit any lapse during the term of this Agreement.

ARTICLE 10
INDEMNITY AND INSURANCE

10.1 Contractor covenants and agrees to FULLY INDEMNIFY and HOLD HARMLESS Owner and its component institutions, the UNTS Board of Regents, elected and appointed officials, directors, officers, employees, agents, representatives, and volunteers, individually or collectively, from and against any and all costs, claims, liens, damages, losses, expenses, fees, fines, penalties, proceedings, actions, demands, causes of action, liability, and suits of any kind and nature, including but not limited to, personal or bodily injury, death, or property damage, made upon Owner directly or indirectly arising out of, resulting from, or related to Contractor’s activities under the Contract, including any acts or omissions of Contractor, or any director, officer, employee, agent, representative, consultant, or Subcontractor of Contractor, and their respective directors, officers, employees, agents, and representatives while in the exercise of performance of the rights or duties under the Contract. The indemnity provided for in this paragraph does not apply to any liability resulting from the negligence of Owner or separate contractors in instances where such negligence causes personal injury, death, or property damage. IN THE EVENT CONTRACTOR AND OWNER ARE FOUND JOINTLY LIABLE BY A COURT OF COMPETENT JURISDICTION, LIABILITY WILL BE APPORTIONED COMPARATIVELY IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS, WITHOUT WAIVING ANY GOVERNMENTAL IMMUNITY AVAILABLE TO THE STATE UNDER TEXAS LAW AND WITHOUT WAIVING ANY DEFENSES OF THE PARTIES UNDER TEXAS LAW.

10.1.1 The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

10.1.2 Contractor shall promptly advise Owner in writing of any claim or demand against Owner or against Contractor known to Contractor related to or arising out of Contractor’s activities under this Contract.

10.2 Insurance.

10.2.1 Contractor shall not commence work under the Agreement until it has obtained all insurance required in accordance with this Agreement and the Uniform General Conditions and until such insurance has been reviewed and approved in writing by Owner. Approval of the insurance by Owner shall not relieve nor decrease the liability of Contractor hereunder. Prior to commencing any of Work Contractor shall provide evidence as required by this Article that demonstrates coverage for Employer’s Liability, Workers’ Compensation, Commercial General Liability, and Automobile Liability as set forth in the Uniform General Conditions are in full force and effect. Prior to commencing any construction work, Builder’s Risk as set forth in the Uniform General Conditions shall be in full force and effect and shall be increased as necessary for each separate bid package, phase, or Stage of construction prior to the commencement of construction for that package, phase, or Stage. No retainage is to be withheld with respect to the cost of the required insurance.

Owner shall obtain builder’s risk insurance coverage for the Project. In the event of an insured loss caused by the action or inaction of Contractor, or by any subcontractor or sub-subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, Contractor shall be responsible for, and reimburse to Owner, any applicable deductible under the builder’s risk insurance
policy, which may be up to $25,000. Any costs associated with Contractor's responsibility for the applicable deductible shall not be considered cost of Work.

10.2.2 Contractor shall include Owner, {Campus if different from Owner} and the Board of Regents of the University of North Texas System as loss payees and Additional Insured’s on General Liability and Business Automobile Liability. The Commercial General Liability, Business Automobile Liability, and Worker’s Compensation policies shall include a waiver of subrogation in favor of Owner.

10.2.3 Insurance policies required under this Article shall contain a provision that the insurance company must give Owner written notice transmitted in writing: (a) thirty (30) calendar days before coverage is non-renewed by the insurance company and (b) within ten (10) business days after cancellation of coverage by the insurance company. Prior to start of Services and upon renewal or replacement of the insurance policies, Contractor shall furnish Owner with certificates of insurance until one year after acceptance of the Services. If any insurance policy required under this Article is not to be immediately replaced without lapse in coverage when it expires, exhausts it limits, or is to be cancelled, Contractor will give Owner written notice within forty-eight (48) hours upon actual or constructive knowledge of such condition.

10.2.4 Owner reserves the right to review the insurance requirements set forth in this Article during the effective period of the Agreement and to make reasonable adjustments to the insurance coverage and their limits when deemed necessary and prudent by Owner based upon changes in statutory law, court decisions, or the claims history of the industry as well as Contractor.

10.2.5 Owner shall be entitled, upon request, and without expense, to receive copies of the policies, all endorsements thereto and documentation to support costs and may make any reasonable requests for deletion, or revision or modification of particular policy terms, conditions, limitations, exclusions and costs, except where policy provisions are established by law or regulation binding upon either of the Parties or the underwriter of any of such policies. Any price credits determined in the insurance review will be refundable to Owner. Actual losses not covered by insurance as required by this Article shall be paid by the Contractor.

10.2.6 Contractor shall not cause or allow any of its insurance to be canceled nor permit any lapse during the term of the Agreement or as required in the Agreement.

ARTICLE 11
TERMINATION AND SUSPENSION

11.1 With or without cause, Owner reserves and has the right to terminate this Agreement or to cancel, suspend or abandon execution of all or any Services in connection with this Agreement at any time upon written notice to Contractor. Contractor may terminate this Agreement upon seven (7) days written notice to Owner only if Owner substantially fails to perform its obligations under Article 6 of this Agreement or fails to timely pay Contractor as required under Article 8, and after adequate written notice is delivered to Owner and Owner has failed to take action within thirty (30) days in order to begin to correct the problem.

11.1.1 In the event of termination, cancellation, suspension, or abandonment that is not the fault of Contractor, Owner shall pay to Contractor as full payment for all services performed and all expenses incurred under this Agreement, the appropriate portion of Contract Sum due under Article 8 as shall have become payable because of the progress in the Work as the services actually rendered hereunder by Contractor bear to the total services necessary.
11.1.2 In ascertaining the services actually rendered hereunder up to the date of termination, cancellation, suspension, or abandonment of this Agreement, consideration shall be given to both completed work and work in progress, to complete and incomplete Drawings, and to other related documents, whether delivered to Owner or in possession of Contractor.

11.1.3 For any said sum paid under this Article, Contractor agrees to accept same in full settlement of all claims for services rendered under this Agreement.

11.2 If, upon payment of the amount required to be paid under this Article following the termination of this Agreement, Owner thereafter should determine to complete the original project or, substantially, the same project without major change in scope; Owner, for such purposes, shall have the right of utilization of any and all original tracings, Drawings, calculations, design analysis, Specifications, estimates, related data, and other documents including Construction Documents, prepared under this Agreement by Contractor who shall make them available to Owner upon request, with compensation to Contractor limited to actual reproduction costs. Owner agrees to credit Contractor with such authorship as may be due to him but is not required to renew this Agreement.

11.3 Upon request at the termination, cancellation, suspension, or abandonment of this Agreement, Contractor agrees to furnish to Owner copies of the latest documents prepared by Contractor for the Project.

11.4 A termination, cancellation, suspension, or abandonment under this Article shall not relieve Contractor or any of its employees of liability for violations of this Agreement, or any willful, negligent or accidental act or omission of Contractor. In the event of a termination under this Article, Contractor hereby consents to employment by Owner of a substitute contractor to complete the services under this Agreement, with the substitute contractor having all rights and privileges of the original contractor of the Project.

ARTICLE 12
MISCELLANEOUS

12.1 Assignment. The terms and conditions of this Agreement shall be binding upon the Parties, their partners, successors, permitted assigns, and legal representatives. This Agreement is a service contract for the services of Contractor, and Contractor's interest in this Agreement, duties hereunder and/or fees due hereunder may not be assigned or delegated to a third party. The benefits and burdens of this Agreement are, however, assignable by Owner to a component or affiliate of Owner or a branch or agency of the State of Texas.

12.2 Death or Incapacity. If Contractor transacts business as an individual, his death or incapacity shall automatically terminate this Agreement as of the date of such event, and neither he nor his estate shall have any further right to perform hereunder; and Owner shall pay him or his estate the compensation payable under the Agreement for any services rendered prior to such termination. If Contractor is a firm comprised of more than one principal and any one of the members thereof dies or becomes incapacitated and the other members continue to render the services covered herein, Owner will make payments to those continuing as though there had been no such death or incapacity, and Owner will not be obliged to take any account of the person who died or became incapacitated or to make any payment to such person or his estate. This provision shall apply in the event of progressive or simultaneous occasions of death or incapacity among any group of persons named as Contractor; and if death or incapacity befalls the last one of such group before this Agreement is fully performed, then the rights shall be as if there had been only one Contractor. In any event, notice of the death or incapacity of any principal shall be given to Owner by any surviving principal within a reasonable time.

12.3 Irreparable Injury. It is acknowledged and agreed that Contractor's services to Owner are unique, which gives a peculiar value to Owner and for the loss of which Owner cannot be reasonably or
adequately compensated in damages; accordingly, Contractor acknowledges and agrees that a breach by Contractor of the provisions hereof will cause Owner irreparable injury and damage. Contractor, therefore, expressly agrees that Owner shall be entitled to injunctive and/or other equitable relief in any court of competent jurisdiction to prevent or otherwise restrain a breach of this Agreement, but only if Owner is not in breach of this Agreement.

12.4  Certifications.

12.4.1 Pursuant to Texas Family Code, Section 231.006, Contractor certifies that it is not ineligible to receive the award of or payments under this Agreement and acknowledges that this Agreement may be terminated and payment may be withheld if this certification is inaccurate.

12.4.2 Pursuant to Texas Government Code, Section 2155.004, Contractor certifies that the business entity named in this Agreement is not ineligible to receive the award of or payments under this Agreement and acknowledges that this Agreement may be terminated and payment withheld if this certification is inaccurate.

12.4.3 If a corporate or limited liability company, Contractor certifies that it is not currently delinquent in the payment of any Franchise Taxes due under Texas Tax Code, Chapter 171, or that the corporation or limited liability company is exempt from the payment of such taxes, or that the corporation or limited liability company is an out-of-state corporation or limited liability company that is not subject to the Texas Franchise Tax, whichever is applicable.

12.4.4 Pursuant to Texas Government Code Sections 2107.008 and 2252.903, Contractor agrees that any payments owing to Contractor under this Agreement may be applied directly toward any debt or delinquency that Contractor owes the State of Texas or any agency of the State of Texas regardless of when it arises, until such debt or delinquency is paid in full.

12.4.5 Pursuant to Texas Government Code Chapter 2252, Subchapter F, Contractor certifies that it is not engaged in business with Iran, Sudan, or a foreign terrorist organization. Contractor acknowledges this Agreement may be terminated if this certification is inaccurate.

12.4.6 Pursuant to Texas Government Code Sections 2252.201-2252.205, Contractor certifies that it is in compliance with the requirement that any iron or steel product produced through a manufacturing process and used in the Project is produced in the United States.

12.4.7 To the extent required by Texas Government Code Chapter 2270, Contractor certifies that it does not currently boycott Israel and will not boycott Israel during the Term of this Agreement. Contractor acknowledges this Agreement may be terminated and payment withheld if this certification is inaccurate.

12.4.8 By signature hereon, Contractor certifies that no member of the Board of Regents of the University of North Texas System, or executive officers, including component institutions, has a financial interest, directly or indirectly, in the transaction that is the subject of this Agreement.

12.5  Business Ethics. During the performance of Contractor’s contract responsibilities, Contractor agrees to maintain business ethics standards aimed at avoiding any impropriety or conflict of interest with Owner’s best interests. Neither Contractor nor its employees, agents, representatives, or subcontractors will assist or cause Owner to violate Owner’s Conflicts of Interest Policy or applicable state ethics laws or rules.
12.6 **Illegal Dumping.** Contractor shall ensure that it and all of its subcontractors and assigns prevent illegal dumping of litter in accordance with Title 5, Texas Health and Safety Code, Chapter 365.

12.7 **Asbestos Containing Materials.**

12.7.1 Contractor shall provide a notarized certification to Owner that all equipment and materials used in fulfillment of its Contract responsibilities are non-Asbestos Containing Building Materials (ACBM) no later than Contractor's application for Final Payment as required by the Uniform General Conditions.

12.7.2 All materials used in this Project shall be certified as non-ACBM. Contractor shall take whatever measures it deems necessary to insure that all employees, suppliers, fabricators, material men, subcontractors, or their assigns, comply with the following acts:

12.7.2.1 Asbestos Hazard Emergency Response Act (AHERA—40 CFR 763, Subpart E)

12.7.2.2 National Emission Standards for Hazardous Air Pollutants (NESHAP—EPA 40 CFR 61, Subpart M, National Emission Standard for Asbestos)

12.7.2.3 Texas Asbestos Health Protection Rules (TAHRP—Tex. Admin. Code Title 25, Part 1, Ch. 295, Subchapter C, Asbestos Health Protection)

12.8 **Records.** Records of Contractor's costs, reimbursable expenses pertaining to the Project and payments shall be kept on a generally recognized accounting basis and shall be made available to Owner or its authorized representative during business hours for audit or other purposes as determined by Owner. Such records shall be maintained by Contractor and shall be available to Owner or his authorized representative for a period of at least five (5) years after the provision of Contractor's Services.

12.9 **Notices.** All notices, consents, approvals, demands, requests or other communications provided for or permitted to be given under any of the provisions of this Agreement shall be in writing and shall be deemed to have been duly given or served when delivered by hand delivery or when deposited in the U.S. Mail by registered or certified mail, return receipt requested, postage prepaid, and addressed as follows:

If to Owner:

(Name)

(Title)

University of North Texas (System or Institution Name)

1155 Union Circle #311040

Denton, Texas 76203-5017

If to Contractor:

(Contact Name)

(Firm Name)

(Street Address)

(City, State Zip)

or to such other person or address as may be given in writing by either party to the other in accordance with the aforesaid.

12.10 **Independent Contractor.** Contractor recognizes that it is engaged as an independent contractor and acknowledges that Owner will have no responsibility to provide transportation, insurance or other fringe benefits normally associated with employee status. Contractor, in accordance with its status as an independent contractor, covenants and agrees that it shall conduct itself consistent with such status, that it will neither hold itself out as nor claim to be an officer, partner, employee or agent of Owner by reason hereof, and that it will not by reason hereof make any claim, demand or application to or for any right or privilege applicable to an officer, partner, employee or agent of Owner, including, but not limited to, unemployment insurance benefits, social security coverage or
retirement benefits. Contractor hereby agrees to make its own arrangements for any of such benefits as it may desire and agrees that it is responsible for all income taxes required by applicable law.

12.11 **Loss of Funding.** Performance by Owner under the Agreement may be dependent upon the appropriation and allotment of funds by the Texas State Legislature (the “Legislature”) and/or allocation of funds by the Board of Regents of The University of North Texas System (the “Board”). If the Legislature fails to appropriate or allot the necessary funds, or the Board fails to allocate the necessary funds, then Owner shall issue written notice to Contractor and Owner may terminate the Agreement. Contractor acknowledges that appropriation, allotment, and allocation of funds are beyond the control of Owner.

12.12 **Confidentiality.** All information owned, possessed or used by Owner which is communicated to, learned, developed or otherwise acquired by Contractor in the performance of services for Owner, which is not generally known to the public, shall be confidential and Contractor shall not, beginning on the date of first association or communication between Owner and Contractor and continuing through the term of this Agreement and any time thereafter, disclose, communicate or divulge, or permit disclosure, communication or divulgence, to another or use for Contractor’s own benefit or the benefit of another, any such confidential information, unless required by law. Except when defined as part of the Work, Contractor shall not make any press releases, public statements, or advertisement referring to the Project or the engagement of Contractor as an independent contractor of Owner in connection with the Project, or release any information relative to the Project for publications, advertisement or any other purpose without the prior written approval of Owner. Contractor shall obtain assurances similar to those contained in this subparagraph from persons, and subcontractors retained by Contractor. Contractor acknowledges and agrees that a breach by Contractor of the provisions hereof will cause Owner irreparable injury and damage. Contractor, therefore, expressly agrees that Owner shall be entitled to injunctive and/or other equitable relief in any court of competent jurisdiction to prevent or otherwise restrain a breach of this Agreement.

12.13 **Open Records.** Owner shall release information to the extent required by the Texas Public Information Act and other applicable law. If required, Contractor shall make public information available to Owner in an electronic format. The requirements of Subchapter J, Chapter 552, Government Code, may apply to this Agreement and Contractor agrees that the Agreement can be terminated if Contractor knowingly or intentionally fails to comply with a requirement of that subchapter.

12.14 **Governing Law and Venue.** This Agreement and all of the rights and obligations of the parties hereto and all of the terms and conditions hereof shall be construed, interpreted and applied in accordance with and governed by and enforced under the laws of the State of Texas and venue shall be as provided in Texas Education Code Section 105.151 for any legal proceeding pertaining to this Agreement.

12.15 **Waivers.** No delay or omission by either of the parties hereto in exercising any right or power accruing upon the non-compliance or failure of performance by the other party hereto 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 either of the parties hereto of any of the covenants, conditions or agreements hereof to be performed by the other party hereto shall not be construed to be a waiver of any subsequent breach thereof or of any other covenant, condition or agreement herein contained.

12.16 **Severability.** Should any term or provision of this Agreement be held invalid or unenforceable in any respect, the remaining terms and provisions shall not be affected and this Agreement shall be construed as if the invalid or unenforceable term or provision had never been included.
IN WITNESS WHEREOF the parties hereto have executed this Agreement in the day and year first above written.

OWNER:
UNIVERSITY OF NORTH TEXAS
{SYSTEM OR INSTITUTION NAME}

By: ________________________________  
(signed)

[Authorized Signatory Name]  
[Authorized Signatory Title]

Date: ________________________________

CONTRACTOR:
{FIRM NAME}

By: ________________________________  
(signed)

____________________________________  
(typed name and title)

Date: ________________________________

Street/PO Box: ________________________________

City, State, ZIP: ________________________________

Telephone: ________________________________

State of TX Vendor ID Number: ________________________________
EXHIBIT A
SPECIFICATIONS, DRAWINGS, AND ADDENDA

SPECIFICATIONS
As listed in project manual titled [Title], prepared by [Professional], issued for construction on [Date].

DRAWINGS
Entitled [Title], as prepared by [Professional], issued for construction on [Date], consisting of the following pages:

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<th>Title</th>
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ADDENDA

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GENERAL CONSTRUCTION AGREEMENT

Exhibit A
HUB Subcontracting Plan (HSP)

QUICK CHECKLIST

While this HSP Quick Checklist is being provided to merely assist you in readily identifying the sections of the HSP form that you will need to complete, it is very important that you adhere to the instructions in the HSP form and instructions provided by the contracting agency.

► If you will be awarding all of the subcontracting work you have to offer under the contract to only Texas certified HUB vendors, complete:
  - Section 1 - Respondent and Requisition Information
  - Section 2 a. - Yes, I will be subcontracting portions of the contract.
  - Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors.
  - Section 2 c. - Yes
  - Section 4 - Affirmation
  - GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

► If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a continuous contract* in place for more than five (5) years meets or exceeds the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:
  - Section 1 - Respondent and Requisition Information
  - Section 2 a. - Yes, I will be subcontracting portions of the contract.
  - Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
  - Section 2 c. - No
  - Section 2 d. - Yes
  - Section 4 - Affirmation
  - GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

► If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors or only to Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a continuous contract* in place for more than five (5) years does not meet or exceed the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:
  - Section 1 - Respondent and Requisition Information
  - Section 2 a. - Yes, I will be subcontracting portions of the contract.
  - Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
  - Section 2 c. - No
  - Section 2 d. - No
  - Section 4 - Affirmation
  - GFE Method B (Attachment B) - Complete an Attachment B for each of the subcontracting opportunities you listed in Section 2 b.

► If you will not be subcontracting any portion of the contract and will be fulfilling the entire contract with your own resources (i.e., employees, supplies, materials and/or equipment), complete:
  - Section 1 - Respondent and Requisition Information
  - Section 2 a. - No, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources.
  - Section 3 - Self Performing Justification
  - Section 4 - Affirmation

*Continuous Contract: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.
HUB Subcontracting Plan (HSP)

In accordance with Texas Gov’t Code §2161.252, the contracting agency has determined that subcontracting opportunities are probable under this contract. Therefore, all respondents, including State of Texas certified Historically Underutilized Businesses (HUBs) must complete and submit this State of Texas HUB Subcontracting Plan (HSP) with their response to the bid requisition (solicitation).

NOTE: Responses that do not include a completed HSP shall be rejected pursuant to Texas Gov’t Code §2161.252(b).

The HUB Program promotes equal business opportunities for economically disadvantaged persons to contract with the State of Texas in accordance with the goals specified in the 2009 State of Texas Disparity Study. The statewide HUB goals defined in 34 Texas Administrative Code (TAC) §20.284 are:

- 11.2 percent for heavy construction other than building contracts,
- 21.1 percent for all building construction, including general contractors and operative builders’ contracts,
- 32.9 percent for all special trade construction contracts,
- 23.7 percent for professional services contracts,
- 26.0 percent for all other services contracts, and
- 21.1 percent for commodities contracts.

- - Agency Special Instructions/Additional Requirements - -

In accordance with 34 TAC §20.285(d)(1)(D)(iii), a respondent (prime contractor) may demonstrate good faith effort to utilize Texas certified HUBs for its subcontracting opportunities if the total value of the respondent’s subcontracts with Texas certified HUBs meets or exceeds the statewide HUB goal or the agency specific HUB goal, whichever is higher. When a respondent uses this method to demonstrate good faith effort, the respondent must identify the HUBs with which it will subcontract. If using existing contracts with Texas certified HUBs to satisfy this requirement, only the aggregate percentage of the contracts expected to be subcontracted to HUBs with which the respondent does not have a continuous contract* in place for more than five (5) years shall qualify for meeting the HUB goal. This limitation is designed to encourage vendor rotation as recommended by the 2009 Texas Disparity Study.

SECTION 1: RESPONDENT AND REQUISITION INFORMATION

a. Respondent (Company) Name: __________________________ State of Texas VID #: __________________________
   Point of Contact: ___________________________________ Phone #: __________________________
   E-mail Address: _____________________________________ Fax #: __________________________

b. Is your company a State of Texas certified HUB? ☐ - Yes ☐ - No

c. Requisition #: __________________________ Bid Open Date: (mm/dd/yyyy)
SECTION 2: RESPONDENT’s SUBCONTRACTING INTENTIONS

After dividing the contract work into reasonable lots or portions to the extent consistent with prudent industry practices, and taking into consideration the scope of work to be performed under the proposed contract, including all potential subcontracting opportunities, the respondent must determine what portions of work, including contracted staffing, goods and services will be subcontracted. Note: In accordance with 34 TAC §20.282, a “Subcontractor” means a person who contracts with a prime contractor to work, to supply commodities, or to contribute toward completing work for a governmental entity.

a. Check the appropriate box (Yes or No) that identifies your subcontracting intentions:

- Yes, I will be subcontracting portions of the contract. (If Yes, complete Item b of this SECTION and continue to Item c of this SECTION.)
- No, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources, including employees, goods and services. (If No, continue to SECTION 3 and SECTION 4.)

b. List all the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

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<tr>
<th>Item #</th>
<th>Subcontracting Opportunity Description</th>
<th>HUBs</th>
<th>Non-HUBs</th>
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<td>Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years.</td>
<td>Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years.</td>
<td>Percentage of the contract expected to be subcontracted to non-HUBs.</td>
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Aggregate percentages of the contract expected to be subcontracted:

(Note: If you have more than fifteen subcontracting opportunities, a continuation sheet is available online at https://www.comptroller.texas.gov/purchasing/vendor/hub/forms.php).

c. Check the appropriate box (Yes or No) that indicates whether you will be using only Texas certified HUBs to perform all of the subcontracting opportunities you listed in SECTION 2, Item b.

- Yes (If Yes, continue to SECTION 4 and complete an “HSP Good Faith Effort - Method A (Attachment A)” for each of the subcontracting opportunities you listed.)
- No (If No, continue to Item d, of this SECTION.)

d. Check the appropriate box (Yes or No) that indicates whether the aggregate expected percentage of the contract you will subcontract with Texas certified HUBs with which you do not have a continuous contract* in place with for more than five (5) years, meets or exceeds the HUB goal the contracting agency identified on page 1 in the “Agency Special Instructions/Additional Requirements.”

- Yes (If Yes, continue to SECTION 4 and complete an “HSP Good Faith Effort - Method A (Attachment A)” for each of the subcontracting opportunities you listed.)
- No (If No, continue to SECTION 4 and complete an “HSP Good Faith Effort - Method B (Attachment B)” for each of the subcontracting opportunities you listed.)

*Continuous Contract: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into “new” contracts.
### SECTION 2: RESPONDENT's SUBCONTRACTING INTENTIONS (CONTINUATION SHEET)

This page can be used as a continuation sheet to the HSP Form's page 2, Section 2, Item b. Continue listing the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

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**Aggregate percentages of the contract expected to be subcontracted:**

- HUBs: %
- Non-HUBs: %

*Continuous Contract: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into “new” contracts.
Enter your company’s name here: ____________________________________ Requisition #: ____________________________

SECTION 3: SELF PERFORMING JUSTIFICATION (If you responded “No” to SECTION 2, Item a, you must complete this SECTION and continue to SECTION 4.) If you responded “No” to SECTION 2, Item a, in the space provided below explain how your company will perform the entire contract with its own employees, supplies, materials and/or equipment.

SECTION 4: AFFIRMATION
As evidenced by my signature below, I affirm that I am an authorized representative of the respondent listed in SECTION 1, and that the information and supporting documentation submitted with the HSP is true and correct. Respondent understands and agrees that, if awarded any portion of the requisition:

• The respondent will provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor for the awarded contract. The notice must specify at a minimum the contracting agency’s name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency’s point of contact for the contract no later than ten (10) working days after the contract is awarded.

• The respondent must submit monthly compliance reports (Prime Contractor Progress Assessment Report – PAR) to the contracting agency, verifying its compliance with the HSP, including the use of and expenditures made to its subcontractors (HUBs and Non-HUBs). (The PAR is available at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/ProgressAssessmentReportForm.xls).

• The respondent must seek approval from the contracting agency prior to making any modifications to its HSP, including the hiring of additional or different subcontractors and the termination of a subcontractor the respondent identified in its HSP. If the HSP is modified without the contracting agency’s prior approval, respondent may be subject to any and all enforcement remedies available under the contract or otherwise available by law, up to and including debarment from all state contracting.

• The respondent must, upon request, allow the contracting agency to perform on-site reviews of the company’s headquarters and/or work-site where services are being performed and must provide documentation regarding staffing and other resources.

__________________________  ____________________________  ____________________________  ____________________________
Signature                     Printed Name                      Title                      Date (mm/dd/yyyy)

Reminder:

➤ If you responded “Yes” to SECTION 2, Items c or d, you must complete an “HSP Good Faith Effort - Method A (Attachment A)” for each of the subcontracting opportunities you listed in SECTION 2, Item b.

➤ If you responded “No” SECTION 2, Items c and d, you must complete an “HSP Good Faith Effort - Method B (Attachment B)” for each of the subcontracting opportunities you listed in SECTION 2, Item b.
HSP Good Faith Effort - Method A (Attachment A)

Enter your company’s name here: ___________________________       Requisition #: __________________

IMPORTANT: If you responded ‘Yes’ to SECTION 2, Items c or d of the completed HSP form, you must submit a completed “HSP Good Faith Effort - Method A (Attachment A)” for each of the subcontracting opportunities you listed in SECTION 2, Item b of the completed HSP form. You may photo-copy this page or download the form at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-sbcont-plan-gfe-achm-a.pdf

SECTION A-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number:    Description:__________________________

SECTION A-2: SUBCONTRACTOR SELECTION

List the subcontractor(s) you selected to perform the subcontracting opportunity you listed above in SECTION A-1. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas’ Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at http://mycpa.cpa.state.tx.us/tasscmblsearch/index.jsp. HUB status code “A” signifies that the company is a Texas certified HUB.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Texas certified HUB</th>
<th>Texas VID or federal EIN</th>
<th>Approximate Dollar Amount</th>
<th>Expected Percentage of Contract</th>
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REMINDER: As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting agency’s name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency’s point of contact for the contract no later than ten (10) working days after the contract is awarded.
**HSP Good Faith Effort - Method B (Attachment B)**

**IMPORTANT:** If you responded “No” to SECTION 2, Items c and d of the completed HSP form, you must submit a completed “HSP Good Faith Effort - Method B (Attachment B)” for each of the subcontracting opportunities you listed in SECTION 2, Item b of the completed HSP form. You may photo-copy this page or download the form at [https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-subcontracting-opportunity-notification-form.pdf](https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-subcontracting-opportunity-notification-form.pdf).

### SECTION B-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

**Item Number:** [ ] **Description:** [ ]

### SECTION B-2: MENTOR PROTÉGÉ PROGRAM

If respondent is participating as a Mentor in a State of Texas Mentor Protégé Program, submitting its Protégé (Protégé must be a State of Texas certified HUB) as a subcontractor to perform the subcontracting opportunity listed in SECTION B-1, constitutes a good faith effort to subcontract with a Texas certified HUB towards that specific portion of work.

Check the appropriate box (Yes or No) that indicates whether you will be subcontracting the portion of work you listed in SECTION B-1 to your Protégé.

- [ ] Yes (If Yes, continue to SECTION B-4.)
- [ ] No / Not Applicable (If No or Not Applicable, continue to SECTION B-3 and SECTION B-4.)

### SECTION B-3: NOTIFICATION OF SUBCONTRACTING OPPORTUNITY

When completing this section you MUST comply with items a, b, c and d, thereby demonstrating your Good Faith Effort of having notified Texas certified HUBs and trade organizations or development centers about the subcontracting opportunity you listed in SECTION B-1. Your notice should include the scope of work, information regarding the location to review plans and specifications, bonding and insurance requirements, required qualifications, and identify a contact person.

When sending notice of your subcontracting opportunity, you are encouraged to use the attached HUB Subcontracting Opportunity Notice form, which is also available online at [https://www.comptroller.texas.gov/purchasing/docs/hub-forms/HUBSubcontractingOpportunityNotificationForm.pdf](https://www.comptroller.texas.gov/purchasing/docs/hub-forms/HUBSubcontractingOpportunityNotificationForm.pdf).

Retain supporting documentation (i.e., certified letter, fax, e-mail) demonstrating evidence of your good faith effort to notify the Texas certified HUBs and trade organizations or development centers. Also, be mindful that a working day is considered a normal business day of a state agency, not including weekends, federal or state holidays, or days the agency is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be “day zero” and does not count as one of the seven (7) working days.

- [ ] Yes 
- [ ] No

**a.** Provide written notification of the subcontracting opportunity you listed in SECTION B-1, to three (3) or more Texas certified HUBs. Unless the contracting agency specified a different time period, you must allow the HUBs at least seven (7) working days to respond to the notice prior to you submitting your bid response to the contracting agency. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas’ Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at [http://mycpa.cpa.state.tx.us/basscombs/search/index.jsp](http://mycpa.cpa.state.tx.us/basscombs/search/index.jsp). HUB status code “A” signifies that the company is a Texas certified HUB.

**b.** List the **three (3) Texas certified HUBs** you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the company’s Texas Vendor Identification (VID) Number, the date you sent notice to that company, and indicate whether it was responsive or non-responsive to your subcontracting opportunity notice.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Texas VID (Do not enter Social Security Numbers)</th>
<th>Date Notice Sent (mm/dd/yyyy)</th>
<th>Did the HUB Respond?</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td>[ ] Yes  [ ] No</td>
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<td>[ ] Yes  [ ] No</td>
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</tbody>
</table>

**c.** Provide written notification of the subcontracting opportunity you listed in SECTION B-1 to two (2) or more trade organizations or development centers in Texas to assist in identifying potential HUBs by disseminating the subcontracting opportunity to their members/participants. Unless the contracting agency specified a different time period, you must provide your subcontracting opportunity notice to trade organizations or development centers at least seven (7) working days prior to submitting your bid response to the contracting agency. A list of trade organizations and development centers that have expressed an interest in receiving notices of subcontracting opportunities is available on the Statewide HUB Program’s webpage at [https://www.comptroller.texas.gov/purchasing/vendor/hub/resources.php](https://www.comptroller.texas.gov/purchasing/vendor/hub/resources.php).

**d.** List the **two (2) trade organizations or development centers** you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the date when you sent notice to it and indicate if it accepted or rejected your notice.

<table>
<thead>
<tr>
<th>Trade Organizations or Development Centers</th>
<th>Date Notice Sent (mm/dd/yyyy)</th>
<th>Was the Notice Accepted?</th>
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<tbody>
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<td>[ ] Yes  [ ] No</td>
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<td>[ ] Yes  [ ] No</td>
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(Attachment B)
HSP Good Faith Effort - Method B (Attachment B) Cont.

Enter your company’s name here: ________________________ Requisition #: ________________________

SECTION B-4: SUBCONTRACTOR SELECTION

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

a. Enter the item number and description of the subcontracting opportunity for which you are completing thisAttachment B continuation page.
   
   Item Number: __________________ Description: __________________

b. List the subcontractor(s) you selected to perform the subcontracting opportunity you listed in SECTION B-1. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas’ Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp. HUB status code "A" signifies that the company is a Texas certified HUB.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Texas certified HUB</th>
<th>Texas VID or federal EIN</th>
<th>Approximate Dollar Amount</th>
<th>Expected Percentage of Contract</th>
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If any of the subcontractors you have selected to perform the subcontracting opportunity you listed in SECTION B-1 is not a Texas certified HUB, provide written justification for your selection process (attach additional page if necessary):

REMINDER: As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting agency’s name and its point of contact for the contract, the contract award number, the subcontracting opportunity it (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency’s point of contact for the contract no later than ten (10) working days after the contract is awarded.

Page 2 of 2
(Attachment B)
In accordance with Texas Gov't Code, Chapter 2161, each state agency that considers entering into a contract with an expected value of $100,000 or more shall, before the agency solicits bids, proposals, offers, or other applicable expressions of interest, determine whether subcontracting opportunities are probable under the contract. The state agency I have identified below in Section B has determined that subcontracting opportunities are probable under the requisition to which my company will be responding.

34 Texas Administrative Code, §20.285 requires all respondents (prime contractors) bidding on the contract to provide notice of each of their subcontracting opportunities to at least three (3) Texas certified HUBs (who work within the respective industry applicable to the subcontracting opportunity), and allow the HUBs at least seven (7) working days to respond to the notice prior to the respondent submitting its bid response to the contracting agency. In addition, at least seven (7) working days prior to submitting its bid response to the contracting agency, the respondent must provide notice of each of its subcontracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code §20.282(19)(C).

We respectfully request that vendors interested in bidding on the subcontracting opportunity scope of work identified in Section C, Item 2, reply no later than the date and time identified in Section C, Item 1. Submit your response to the point-of-contact referenced in Section A.

### SECTION A: PRIME CONTRACTOR'S INFORMATION

<table>
<thead>
<tr>
<th>Company Name:</th>
<th>State of Texas VID #:</th>
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<tr>
<th>Point-of-Contact:</th>
<th>Phone #:</th>
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<tr>
<th>E-mail Address:</th>
<th>Fax #:</th>
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### SECTION B: CONTRACTING STATE AGENCY AND REQUISITION INFORMATION

<table>
<thead>
<tr>
<th>Agency Name:</th>
<th>Phone #:</th>
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<tr>
<th>Point-of-Contact:</th>
<th>Requisition #:</th>
<th>Bid Open Date:</th>
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<td>(mm/dd/yyyy)</td>
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### SECTION C: SUBCONTRACTING OPPORTUNITY RESPONSE DUE DATE, DESCRIPTION, REQUIREMENTS AND RELATED INFORMATION

1. Potential Subcontractor's Bid Response Due Date:

   If you would like for our company to consider your company's bid for the subcontracting opportunity identified below in Item 2, we must receive your bid response no later than __________ on __________.

   In accordance with 34 TAC §20.285, each notice of subcontracting opportunity shall be provided to at least three (3) Texas certified HUBs, and allow the HUBs at least seven (7) working days to respond to the notice prior to submitting our bid response to the contracting agency. In addition, at least seven (7) working days prior to us submitting our bid response to the contracting agency, we must provide notice of each of our subcontracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code, §20.282(19)(C).

   (A working day is considered a normal business day of a state agency, not including weekends, federal or state holidays, or days the agency is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be "day zero" and does not count as one of the seven (7) working days.)

2. Subcontracting Opportunity Scope of Work:

3. Required Qualifications:

   - Not Applicable

4. Bonding/Insurance Requirements:

   - Not Applicable

5. Location to review plans/specifications:

   - Not Applicable
PAYMENT BOND

STATE OF TEXAS §
COUNTY OF §

KNOW ALL MEN BY THESE PRESENT: That we, ______________, as Principal, and __________, as Surety, are hereby held and firmly bound unto the University of North Texas System, as Obligee, in the sum of Dollars ($__________) for payment whereof the said Principal and Surety bind themselves, their heirs, executors, administrators, and successors, jointly and severally, by the terms and conditions herein.

The conditions of this obligation are such that whereas the Principal entered into a certain contract with the Obligee, as an entity of the State of Texas, dated the ___day of ____, 200__ (“Contract”), which is hereto attached and made a part hereof for all purposes, for the purpose of _____________________________________________.

NOW THEREFORE, the condition of this obligation is such that this Payment Bond shall remain in full force and effect unless and until 120 days after Principal has faithfully performed the Contract in accordance with the Contract documents and Principal has executed a copy of the attached Payment Affidavit and provided it to Obligee.

In the event that the Principal fails to promptly pay when due any amount owed to persons who have supplied labor, materials, or supplies used in Principal’s performance of the said Contract, the Surety will, upon receipt of notice from the Obligee or a claim in the form required by law, satisfy all undisputed balances due, and make arrangements satisfactory to the interested parties to resolve all amounts disputed in good faith, but in no event shall the liability of the Surety for the Principal’s failure to promptly pay for labor, materials, or supplies exceed the amount of this bond.

The Surety agrees to pay to the Obligee upon demand all loss and expense, including attorney’s fees, incurred by the Obligee by reason of or on account of any breach of this obligation by the Principal or the Surety.

Provided further, that this bond is made and entered into for the protection of all parties supplying labor or materials in the prosecution of the work provided for in the said Contract, and all such parties shall have a direct right of action under this bond as provided in Chapter 2253 of the Texas Government Code. If any legal action is filed upon this bond, venue shall lie in Denton County, Texas.

The liabilities, rights, limitations and remedies concerning this Bond shall be determined in accordance with the provisions of Chapter 2253 of the Texas Government Code, pursuant to which this bond is executed.

IN WITNESS WHEREOF, the above parties have executed this instrument under their several seals this ______ day of ____________ in the year 20___, the name and seal of each party being hereto affixed, and duly signed by its undersigned representative pursuant to authority of its governing body.

CONSTRUCTION MANAGER-AT-RISK

_________________________  _____________________________
(Firm Name)  (Address)

_________________________  _____________________________
(Signature)  (City, State, Zip)

_________________________  _____________________________
(Typed Name and Title)  (Telephone)

(Texas Vendor ID No.)
PERFORMANCE BOND

Surety Bond No.

STATE OF TEXAS §
COUNTY OF §

LET IT BE KNOWN BY THIS INSTRUMENT: That we, ________________________, as Principal, and ________________________, a corporation duly authorized to do business in the State of Texas, as Surety, are hereby held and firmly bound unto the University of North Texas System, as Obligee, in the sum of ____________________ Dollars ($___________) for payment whereof the said Principal and Surety bind themselves, their heirs, executors, administrators, and successors, jointly and severally, by the terms and conditions herein.

The conditions of this obligation are such that whereas the Principal entered into a certain contract with the Obligee, as an entity of the State of Texas, dated the ______ day of ______, 20__ (“Contract”), which is hereto attached and made a part hereof for all purposes, for the purpose of______________________________________________________________.

NOW THEREFORE, the condition of this obligation is such that this Performance Bond shall remain in full force and effect unless and until the Principal has faithfully performed the Contract in accordance with the Plans, Specifications and Contract documents. Further, under the terms of this Performance Bond, Principal shall fully indemnify and save harmless the Obligee from all cost and damage which the Obligee may suffer by reason of Principal’s default or failure to perform and shall fully reimburse and repay the Obligee all outlay and expense which the Obligee may incur in making good any such default.

In the event that the Principal’s failure as defined by the Contract Documents, to faithfully perform the Contract, Surety will within fifteen (15) days of determination of default, assume full responsibility for completion of said Contract and become entitled to payment of the balance of the Contract amount. Conditioned upon the Surety’s faithful performance of its obligations, the liability of the Surety for the Principal’s default shall not exceed the penalty of this Bond.

The Surety agrees to pay to the Obligee upon demand all loss and expense, including attorney’s fees, incurred by the Obligee by reason of or on account of any breach of this obligation by the Principal or the Surety.

Provided further, that the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the said Contract, or to the work to be performed thereunder, or the Specifications accompanying the same, shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition, to the terms of the said Contract or to the work or to the Specifications.

Provided further, that if any legal action be filed upon this Bond, venue shall lie in Denton County, Texas.

The liabilities, rights, limitations and remedies concerning this Bond shall be determined in accordance with the provisions of Chapter 2253 of the Texas Government Code, pursuant to which this Bond is executed.
IN WITNESS WHEREOF, the above parties have executed this instrument under their several seals this ______ day of _____________ in the year 20___, the name and corporate seal of each corporate party being hereto affixed, and these present duly signed by its undersigned representative pursuant to authority of its governing body.

ATTEST:

(Principal)

(Principal)  

(Signature)  

(Signature)  

(Typed Name and Title)  

(Typed Name and Title)

(SEAL)

ATTEST:

(Surety)

(Surety)  

(Signature)  

(Signature)  

(Typed Name and Title)  

(Typed Name and Title)

(SEAL)

Surety’s Texas Local Recording Agent or Resident Agent:  

Surety’s Home Office Agent or Servicing Agent:

(Signature)  

(Signature)  

(Typed Name)  

(Typed Name)  

(License No.)  

(License No.)  

(File No)  

(File No)  

(Address)  

(Address)  

(City, State, Zip)  

(City, State, Zip)  

(Telephone)  

(Telephone)
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FOR CONSTRUCTION AND DESIGN CONTRACTS
2019
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- No Substitutions without Approval ............................................................................................... 13
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- Non-Compliant Work ..................................................................................................................... 13
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ARTICLE 1.
DEFINITIONS

Unless the context clearly requires another meaning, the following terms have the meaning assigned herein.

1.1 “Addendum/Addenda” means formally issued written or graphic modification and/or interpretations of the Construction Documents that may add to, delete from, clarify or correct the description and/or scope of the Work. Addenda are issued during the bidding phase of the project.

1.2 “Application for Final Payment” means Contractor’s final invoice for payment that includes any portion of the Work that has been completed for which an invoice has not been submitted, amounts owing to adjustments to the final Contract Sum resulting from approved change orders, and release of remaining Contractor’s retainage.

1.3 “Application for Payment” means Contractor’s monthly partial invoice for payment that includes any portion of the Work that has been completed and performed in accordance with the requirements of the Contract Documents for which an invoice has not been submitted. The Application for Payment must accurately reflect the progress of the Work, be itemized based on the Schedule of Values, bear the notarized signature of Contractor, and not include subcontracted items for which Contractor does not intend to pay.

1.4 “Authority Having Jurisdiction” means a federal, state, local or other regional department, or an individual such as a fire marshal, building official, electrical inspector, utility provider or other individual having statutory authority.

1.5 “Baseline Schedule” means the initial time schedule prepared by Contractor for Owner’s information and acceptance that conveys Contractor’s and Subcontractors’ activities (including coordination and review activities required in the Contract Documents to be performed by Design Professional and Owner), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule clearly demonstrates the Longest Path of activities, durations, and necessary predecessor conditions that drive the end date of the schedule. The Baseline Schedule shall not exceed the time limit current under the Contract Documents.

1.6 “Certificate of Final Completion” means the certificate issued by Design Professional that documents, to the best of Design Professional’s knowledge and understanding, Contractor’s
completion of all Contractor’s Punch list items and pre-final Punch list items, final cleanup, and Contractor’s provision of Record Documents, operations and maintenance manuals, and all other closeout documents required by the Contract Documents.

1.7 “Certificate of Substantial Completion” means the certificate executed by the Design Professional, Owner, and Contractor that documents to the best of the Design Professional’s and Owner’s knowledge and understanding, Contractor’s sufficient completion of the Work in accordance with the Contract, so as to be operational and fit for the use intended.

1.8 “Change Order” means a written modification of the Contract between Owner and Contractor, agreed to and signed by Owner, Contractor, and Design Professional.

1.9 “Change Order Request (COR)” means a Contractor generated document which describes a change in the scope of Work, including a detailed description, Drawings and Specifications, and a request for changes to costs or time, as necessary, to inform Owner of the nature of the requested change to the Contract.

1.10 “Close-Out Documents” mean the product brochures, submittals, product/equipment maintenance and operations instructions, manuals, and other documents/warranties, record documents, affidavits of payment, releases of liens and claims, and other documents as may be further defined, identified, and required by the Contract Documents.

1.11 “Contract” means the agreement, including all attachments thereto, and all of the Contract Documents between Owner and Contractor.

1.12 “Contract Date” is the date when the agreement between Owner and Contractor becomes effective.

1.13 “Contract Documents” mean those documents identified as a component of the Contract between Owner and Contractor. These may include, but are not limited to: Drawings; Specifications; Uniform General Conditions; Owner’s Special Conditions; Owner’s Design Criteria Package for Design-Build Projects; Guaranteed Maximum Price Proposal executed by Owner and Contractor; all Change Orders; all pre-bid and/or pre-proposal addenda; Owner’s Request for Proposal and/or Request for Qualifications; and Contractor’s response to Owner’s Request for Proposal and/or Request for Qualifications.

1.14 “Contract Duration” means the period between the Effective Date of the Contract and the end of the Warranty Period.

1.15 “Contract Sum” means the total compensation payable to Contractor for completion of the Work in accordance with the terms of the Contract.

1.16 “Contract Time” means the period between the start date identified in the Notice to Proceed with construction and the date to achieve Substantial Completion identified in the Notice to Proceed or as subsequently amended by a Change Order.
1.17 “Contractor” means the individual, corporation, limited liability company, partnership, joint venture, firm, or other entity contracted to perform the Work, regardless of the type of construction contract used, so that the term as used herein includes a Construction Manager-at-Risk or a Design-Build firm as well as a general or prime Contractor. The Contract Documents refer to Contractor as if singular in number but shall be interpreted to include the plural. The term “Contractor” shall also be inclusive of and apply to Design Professional in these Uniform General Conditions when the context does not indicate otherwise.

1.18 “Construction Change Directive” means an approved change in the Work issued by the Owner without the complete agreement of Contractor as to cost and/or time.

1.19 “Construction Documents” mean the Drawings, Specifications, and other documents issued to build the Project. Construction Documents become part of the Contract Documents when listed in the Contract or any Change Order.

1.20 “Construction Manager-at-Risk”, in accordance with Tex. Education Code §51.782, means a sole proprietorship, partnership, corporation, or other legal entity that assumes the risk for construction, rehabilitation, alteration, or repair of a facility at the contracted price as a general contractor and provides consultation to Owner regarding construction during and after the design of the facility.

1.21 “Coordination Documents” means an ongoing process performed by the Contractor that documents, in a format approved by the Owner, the review of plans and specifications developed by the Design Professional demonstrating the Contractor understands the scope of the project and reviews complex interrelationships among project components.

1.22 “Date of Commencement” means the date designated in the Notice to Proceed for Contractor to commence the Work.

1.23 “Day” means a calendar day unless otherwise specifically stipulated.

1.24 “Design-Build” means a project delivery method in which the detailed design and subsequent construction is provided through a single contract with a Design-Build Firm. The Design-Build Project delivery shall be implemented in accordance with Tex. Education Code § 51.780.

1.25 “Design-Build Firm”, in accordance with Texas Education Code § 51.780, means a partnership, corporation, or other legal entity or team that includes an engineer or architect and builder qualified to engage in building construction in Texas.

1.26 “Design Professional” means a person registered as an architect pursuant to Tex. Occ. Code Ann., Chapter 1051, as a landscape architect pursuant to Tex. Occ. Code Ann., Chapter 1052, a person licensed as a professional engineer pursuant Tex. Occ. Code Ann., Chapter 1001, and/or a firm employed by Owner or Design-Build Contractor to provide professional architectural or engineering services and to exercise overall responsibility for the design of a Project or a significant portion thereof, and to perform the contract administration responsibilities set forth in the Contract.
1.27 “Drawings” mean that product and set of documents of Design Professional which graphically depicts the Work.

1.28 “Final Completion” means the date determined and certified by Design Professional and Owner on which the Work is fully and satisfactorily complete in accordance with the Contract.

1.29 “Final Payment” means the last and final monetary compensation made to Contractor for any portion of the Work that has been completed and accepted for which payment has not been made including adjustments to the final Contract Sum resulting from approved change orders and release of Contractor’s retainage.

1.30 “Float” means the period of time a task can be delayed without delaying Substantial Completion date.

1.31 “Historically Underutilized Business (HUB)” pursuant to Tex. Gov’t Code, Chapter 2161, means a business that is at least 51% owned by an Asian Pacific American, a Black American, a Hispanic American, a Native American and/or an American Woman; is an entity with its principal place of business in Texas; and has an owner residing in Texas with proportionate interest that actively participates in the control, operations, and management of the entity’s affairs.

1.32 “Longest Path” means the sequence of directly related activities that comprise the longest continuous chain of activities from the start of the first activity to the finish of the last activity. The activities represent critical path plus float plus historical weather days. Each activity in the Longest Path is critical and directly related in that it prevents its successor from being scheduled earlier than it is.

1.33 “Notice to Proceed” means written document furnished by the Owner informing Contractor of the date to commence the Work and the date anticipated for Substantial Completion.

1.34 “Open Item List” means a list of work activities, Punch list items, changes, or other issues not expected by Owner, Design Professional, and Contractor to be complete prior to Substantial Completion.

1.35 “Owner” means the University of North Texas System and/or its component institutions, as a higher education university system and agency of the State of Texas.

1.36 “Owner’s Construction Manager (OCM)” means the individual assigned by the Owner to act on its behalf and to undertake certain activities as specifically outlined in the Contract. The OCM does not have the authority to bind the Owner or direct changes to the scope, cost, or time of the Contract.

1.37 “Owner’s Designated Representative (ODR)” means the individual assigned by Owner to act on its behalf and to undertake certain activities as specifically outlined in the Contract. The ODR is the only party authorized to direct changes to the scope, cost, or time of the Contract.

1.38 “Progress Assessment Report (PAR)” means the monthly compliance report to Owner verifying compliance with the HUB subcontracting plan (HSP).
1.39 “Project” means all activities necessary for realization and completion of Owner’s desired building or other structure including all ancillary and related work. This includes design, contract award(s), execution of the Work itself, fulfillment of all Contract and warranty obligations, and work by Owner’s forces or other contractors.

1.40 “Project Costs” means all costs necessary for the realization and completion of Owner’s desired building or other structure including all ancillary and related work. This includes design, contract award(s), execution of the Work itself, fulfillment of all Contract and warranty obligations, and work by Owner’s forces or other contractors.

1.41 “Proposal Request (PR)” means a document that informs Contractor, Owner, and Design Professional of a proposed change in the Work and appropriately describes or otherwise documents such change including Contractor’s pricing for the proposed change.

1.42 “Punch list” means a list of items of Work to be completed or corrected by Contractor before Final Completion, and indicates items to be finished, remaining Work to be performed, or Work that does not meet quality or quantity requirements as required in the Contract Documents.

1.43 “Reasonably Inferable” means a fair, proper, and moderate conclusion reached by considering all of the facts and deducing a logical conclusion from them.

1.44 “Record Documents” mean the Drawings, Specifications, and other materials maintained by Contractor during construction and as corrected by Design Professional, that documents all addenda, Architect’s Supplemental Instructions, Change Orders, and postings and markings that record the as-built conditions of the Work and all changes made during construction.

1.45 “Request for Information (RFI)” means a written request by Contractor directed to Design Professional and Owner for a clarification of the information provided in the Contract Documents or for direction concerning information necessary to perform the Work.

1.46 “Samples” mean representative physical examples of materials, equipment, or workmanship used to confirm compliance with requirements and/or to establish standards for use in execution of the Work.

1.47 “Schedule of Values” means the detailed breakdown of the cost of the materials, labor, and equipment necessary to accomplish the Work, submitted by Contractor for approval by Owner and Design Professional.

1.48 “Shop Drawings” mean the drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data prepared by Contractor or its agents which detail a portion of the Work.

1.49 “Site” means the geographical area of the location of the Work.

1.50 “Special Conditions” mean the documents containing terms and conditions which may be unique to the Work or Project.
“Specifications” mean the written product of Design Professional that establishes the quality and/or performance of products utilized in the Work and processes to be used, including testing and verification for producing the Work.

“Subcontractor” means an individual or entity that enters into an agreement with Contractor to perform part of the Work or to provide services, materials, or equipment for use in the Work.

“Submittal Register” means a list provided by Contractor of all items to be furnished for review and approval by Design Professional and Owner and as identified in the Contract Documents including anticipated sequence and submittal dates.

“Substantial Completion” means the date determined and certified by Contractor, Design Professional, and Owner when the Work, or a designated portion thereof, is sufficiently complete, in accordance with the Contract, so as to be operational and fit for the use intended.

“Substantial Completion Date” means the required date for substantial completion of the project. The Substantial Completion Date can only be changed by a written change order.

“Total Float” means the total number of days an activity on the longest path can be delayed without delaying the Substantial Completion Date.

“Unit Price Work” means the Work or a portion of the Work, paid for based on incremental units of measurement.

“Work” means the administration, procurement, materials, equipment, construction, and all services necessary for Contractor, and/or its agents, to fulfill Contractor’s obligations under the Contract.

“Work Progress Schedule” means the continually updated time schedule prepared and monitored by Contractor that coordinates and integrates activities of the Project, including Contractor’s services, Design Professional’s services, the work of other consultants, suppliers, and Owner’s activities with the anticipated construction schedules for other contractors. The Work Progress Schedule accurately indicates all necessary and appropriate revisions, including a Longest Path impact analysis, as required by the conditions of the Work and the Project while maintaining a concise comparison to the Baseline Schedule.

ARTICLE 2.
WAGE RATES AND OTHER LAWS GOVERNING CONSTRUCTION

2.1 Environmental Regulations. Contractor shall conduct activities in compliance with applicable laws and regulations and other requirements of the Contract relating to the environment and its protection at all times. Unless otherwise specifically determined, Contractor is responsible for obtaining and maintaining permits related to storm water run-off. Contractor shall conduct operations consistent with storm water run-off permit conditions. Contractor is responsible for all items it brings to the Site, including hazardous materials, and all such items brought to the Site by
its Subcontractors and suppliers, or by other entities subject to direction of Contractor. Contractor shall not incorporate hazardous materials into the Work without prior approval of Owner, and shall provide an affidavit attesting to such in association with request for Substantial Completion inspection.

2.2 **Wage Rates.** Contractor shall, and shall cause subcontractors to, comply with the Texas Prevailing Wage law. Contractor shall pay not less than the wage scale of the various classes of labor as shown on the prevailing wage schedule as established by the United States Department of Labor in accordance with the Davis-Bacon Act, as amended. The specified wage rates are minimum rates only. Owner is not bound to pay any claims for additional compensation made by Contractor because Contractor pays wages in excess of the applicable minimum rate contained in the Contract. The prevailing wage schedule is not a representation that qualified labor adequate to perform the Work is available locally at the prevailing wage rates. When requested, Contractor shall furnish competent evidence of compliance with the Texas Prevailing Wage Law and the addresses of all workers.

2.2.1 **Notification to Workers.** Contractor shall post the prevailing wage schedule in a place conspicuous to all workers on the Project Site and shall notify each worker, in writing, of the following as they commence Work on the Contract: the worker’s job classification, the established minimum wage rate requirement for that classification, as well as the worker’s actual wage. The notice must be delivered to and signed in acknowledgement of receipt by the worker and must list both the wages and fringe benefits to be paid or furnished for each classification in which the worker is assigned duties.

2.2.1.1 Contractor shall submit a copy of each worker’s wage-rate notification to Owner with the application for progress payment for the period during which the worker was engaged in activities on behalf of the Project.

2.2.1.2 Pursuant to Tex. Gov’t Code § 2258.024, Contractor shall keep, on site, true and accurate records showing the name and occupation of each worker employed by the Contractor or subcontractors and the actual per diem wages paid to each worker. The record shall be open to inspection by the ODR and their agents at all reasonable hours for the duration of the contract.

2.2.1.3 With each application for progress payment, Contractor shall make available upon request certified payroll records, including from subcontractors of any tier level, on Form WH-347 as promulgated by the U.S. Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format, along with copies of any and all Contract Documents between Contractor and any Subcontractor. Pursuant to Tex. Penal Code § 37.02 and 37.10, Employees of Contractor and subcontractors, including all tier levels, shall be subject to prosecution for submitting certified payroll records that contain materially false information.

2.2.1.4 The prevailing wage schedule is determined by Owner in compliance with Tex. Gov’t Code, Chapter 2258. Should Contractor at any time become aware
that a particular skill or trade not reflected on Owner’s prevailing wage schedule will be or is being employed in the Work, whether by Contractor or by Subcontractor, Contractor shall promptly inform Owner of the proposed wage to be paid for the skill along with a justification for same and Owner shall promptly concur with or reject the proposed wage and classification.

2.2.1.5 Contractor is responsible for determining the most appropriate wage for a particular skill in relation to similar skills or trades identified on the prevailing wage schedule. In no case, shall any worker be paid less than the wage indicated for laborers.

2.2.1.6 Pursuant to Tex. Labor Code § 214.008, Misclassification of Workers; Penalty. The Owner requires Contractor and all subcontractors properly classify individuals as Employees or Independent Contractors.

2.2.2 Penalty for Violation. Contractor, and any Subcontractor, will pay to the State a penalty of sixty dollars ($60) for each worker employed for each day, or portion thereof, that the worker is paid less than the wage rates stipulated in the prevailing wage schedule.

2.2.3 Complaints of Violations.

2.2.3.1 Owner’s Determination of Good Cause. Upon receipt of information concerning a violation, Owner will conduct an investigation in accordance with Tex. Gov’t Code, Chapter 2258, and make an initial determination as to whether good cause exists that a violation occurred. Upon making a good cause finding, Owner will retain the full amounts claimed by the claimant or claimants as the difference between wages paid and wages due under the prevailing wage schedule and any supplements thereto, together with the applicable penalties, such amounts being subtracted from successive progress payments pending a final decision on the violation.

2.2.3.2 No Extension of Time. If Owner’s determination proves valid that good cause existed to believe a violation had occurred, Contractor is not entitled to an extension of time for any delay arising directly or indirectly from the arbitration procedures.

2.2.3.3 Cooperation with Owner’s Investigation. Contractor shall cooperate with Owner during any investigation hereunder. Such cooperation shall include, but not necessarily be limited to, timely providing the information and/or documentation requested by Owner, which may include certified payroll records on Form WH-347 as promulgated by the U.S Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format; and copies of any and all Contract Documents between Contractor and any Subcontractors.
2.2.3.4 Notification to Owner. In the event Contractor or Subcontractor elect to appeal an initial determination made pursuant to Paragraph 2.2.3.1, the Contractor and/or Subcontractor, as applicable, shall deliver notice thereof to Owner.

2.3 Licensing of Trades. Contractor shall comply with all applicable provisions of State law related to license requirements for skilled tradesmen, contractors, suppliers, and laborers, as necessary to accomplish the Work. In the event Contractor, or one of its Subcontractors, loses its license during the term of performance of the Contract, Contractor shall promptly hire or contract with a licensed provider of the service at no additional cost to Owner.

2.4 Royalties, Patents, and Copyrights. Contractor shall pay all royalties and license fees, defend suits or claims for infringement of copyrights and patent rights, and shall hold Owner harmless from loss on account thereof. Provided, however, if Contractor is a Construction Manager-at-Risk, Contractor shall not be responsible 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 Owner or Design Professional; unless Contractor has reason to believe that the required design, process, or product is an infringement of a copyright or a patent then Contractor shall be responsible for such loss unless notice of such information is promptly furnished to Design Professional.

2.5 State Sales and Use Taxes. Owner qualifies for exemption from certain State and local sales and use taxes pursuant to the provisions of Tex. Tax Code, Chapter 151. Upon request from Contractor, Owner shall furnish evidence of tax exempt status. Contractor may claim exemption from payment of certain applicable State taxes by complying with such procedures as prescribed by the State Comptroller of Public Accounts. Owner acknowledges not all items qualify for exemption. Owner is not obligated to reimburse Contractor for taxes paid on items that qualify for tax exemption.

2.6 Antiquities. Contractor shall take precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological, or historical significance. No objects of this nature shall be disturbed without written permission of Owner and the Texas Historical Commission. When such objects are uncovered unexpectedly, the Contractor shall stop all Work in close proximity and notify the OCM and the Texas Historical Commission of their presence and shall not disturb them until written permission and permit to do so is granted. All primitive rights and antiquities, as defined in Chapter 191, Texas Natural Resource Code, discovered on the Owner’s property shall remain property of State of Texas. If it is determined by Owner, in consultation with the Texas Historical Commission that exploration or excavation of primitive records or antiquities on the Project Site is necessary to avoid loss, Contractor shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in the Contractor’s cost of, or time required for, performance of the Work, Contractor may file with the Owner a Notice of Claim as described in § 21.1.2.2.

2.7 Franchise Tax Status. Upon request, the Contractor agrees to execute and provide to the Owner a Certification of Franchise Tax Payment, on a form approved by the Owner.
2.8 Conflicts of Interest. Parties shall perform their obligations with integrity, ensuring at a minimum that each: (a) avoids conflicts of interest and promptly discloses any to the other Party; and (b) warrants that it has not and shall not pay or receive any contingent fees or gratuities to or from the other Party, including its agents, officers and employees, subcontractors, sub-consultants or others for whom they may be liable, to secure preferential treatment.

ARTICLE 3.
GENERAL RESPONSIBILITIES OF OWNER

3.1 Preconstruction Conference. Prior to, or concurrent with, the issuance of Notice to Proceed, a conference will be convened for attendance by Owner, Contractor, Design Professional and appropriate Subcontractors. The purpose of the conference is to establish a working understanding among the parties as to the Work, the operational conditions at the Project Site, and general administration of the Project. Topics include communications, schedules, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, maintaining required records and all other matters of importance to the administration of the Project and effective communications between the Project team members.

3.2 Owner’s Construction Manager (OCM). Prior to the start of construction, Owner will identify its OCM, who has the express authority to act on behalf of the Owner to the extent and for the purposes described in the Contract, including responsibilities for general administration of the Contract.

3.2.1 Point of Contact. Unless otherwise specifically defined elsewhere in the Contract Documents, OCM is the single point of contact between Owner and Contractor. Notice to OCM, unless otherwise noted, constitutes notice to Owner under the Contract.

3.2.2 Directives. All directives on behalf of Owner will be conveyed to Contractor and Design Professional by OCM in writing.

3.3 Owner Supplied Materials and Information.

3.3.1 Surveys. Owner will furnish to Contractor those surveys Owner possesses describing the physical characteristics, legal description, limitations of the Site, Site utility locations, and other information used in the preparation of the Contract Documents.

3.3.2 Drawings and Specifications. Owner will furnish or cause to be furnished, free of charge, the number of complete sets, paper or electronic, of the Drawings, Specifications, and addenda as provided in the Contract.

3.3.3 Other Information. Owner will provide information, equipment, or services under Owner’s control to Contractor with reasonable promptness.

3.4 Availability of Lands. Owner will furnish, as indicated in the Contract, all required rights to use the lands upon which the Work occurs. This includes rights-of-way and easements for access and such other lands that are designated for use by Contractor. Contractor shall comply with all Owner
identified encumbrances or restrictions specifically related to use of lands so furnished. Owner will obtain and pay for easements for permanent structures or permanent changes in existing facilities, unless otherwise required in the Contract Documents.

3.5 Limitation on Owner’s Duties.

3.5.1 No Control. Owner will not supervise, direct, control or have authority over, or be responsible for Contractor’s means, methods, technologies, sequences, or procedures of construction or the safety precautions and programs incident thereto. Owner is not responsible for any failure of Contractor to comply with laws and regulations applicable to the Work. Owner is not responsible for the failure of Contractor to perform or furnish the Work in accordance with the Contract Documents. Except as provided in Section 2.4, Owner is not responsible for the acts or omissions of Contractor, or any of its Subcontractors, suppliers, or of any other person or organization performing or furnishing any of the Work on behalf of Contractor.

3.5.2 No Contravention of Design Professional. Owner will not take any action in contravention of a design decision made by Design Professional in preparation of the Contract Documents, when such actions are in conflict with statutes under which Design Professional is licensed for the protection of the public health and safety.

ARTICLE 4.
GENERAL RESPONSIBILITIES OF DESIGN PROFESSIONAL

4.1 Role of Design Professional. Unless specified otherwise in the Contract between Owner and Contractor, in addition to design services Design Professional shall provide general administration services for Owner during the construction phase of the project. Written correspondence, RFIs, and Shop Drawings/submittals shall be directed to Design Professional for determination and action. Design Professional has the authority to act on behalf of Owner to the extent provided in the Contract Documents, unless otherwise modified by written instrument, which will be furnished to Contractor by OCM, upon request.

4.2 Site Visits. Design Professional will make visits to the Site at intervals as provided in the Design Professional’s Contract with Owner, to observe the progress and the quality of the various aspects of Contractor’s executed Work and report findings to OCM.

4.3 Inspections. Design Professional has the authority to interpret Contract Documents and inspect the Work for compliance and conformance with the Contract. Except as referenced in Paragraph 3.1.5.2, Owner retains the sole authority to accept or reject Work and issue direction for correction, removal, or replacement of Work.

4.4 Clarifications and Interpretations. It may be determined that clarifications or interpretations of the Contract Documents are necessary. Such clarifications or interpretations will be provided by Design Professional consistent with the intent of the Contract Documents. Design Professional will issue these clarifications with reasonable promptness to Contractor as Design Professional’s
supplemental instruction ("ASI") or similar instrument. If Contractor believes that such clarification or interpretation justifies an adjustment in the Contract Sum or the Contract Time, Contractor shall so notify Owner in accordance with the provisions of Article 14.

4.5 Limitations on Design Professional Authority. Design Professional is not responsible for:

- Contractor’s means, methods, techniques, sequences, procedures, safety, or programs incident to the Work, nor will Design Professional supervise, direct, control, or have authority over the same;
- The failure of Contractor to comply with laws and regulations applicable to the furnishing or performing the Work;
- Contractor’s failure to perform or furnish the Work in accordance with the Contract Documents; or
- Acts or omissions of Contractor, or of any other person or organization performing or furnishing any of the Work.

ARTICLE 5.
GENERAL RESPONSIBILITIES OF CONTRACTOR

5.1 Contractor’s General Responsibilities. Contractor is solely responsible for implementing the Work in full compliance with all applicable laws and the Contract Documents and shall supervise and direct the Work using the best skill and attention to assure that each element of the Work conforms to the Contract requirements. Contractor is solely responsible for all construction means, methods, techniques, safety, sequences, coordination, procedures and protection of the installed work as part of the contract until Substantial Completion of the project. Contractor remains responsible for the care and protection of materials and Work in the areas where Punch list items are completed until Final Completion.

5.1.1 Site Visit. Contractor shall visit the Site before commencing the Work and become familiar with local conditions such as the location, accessibility and general character of the Site and/or building.

5.2 Project Administration. Contractor shall provide Project administration for all Subcontractors, vendors, suppliers, and others involved in implementing the Work and shall coordinate administration efforts with those of Design Professional and OCM in accordance with these Uniform General Conditions and other provisions of the Contract, and as outlined in the pre-construction conference. Contractor’s Project Administration includes periodic daily reporting on weather, work progress, labor, materials, equipment, obstruction to prosecution of the work, accidents and injuries in accordance with the Contract and transmitted no less frequently than on a weekly basis.

5.2.1 Contractor’s Management Personnel. Contractor shall employ a competent person or persons who will be present at the Project Site during the progress of the Work to supervise or oversee the Work. Contractor’s management personnel are subject to the approval of OCM, and shall be removed and replaced at the request of OCM. Contractor shall not
change approved staff during the course of the Project without the written approval of OCM unless the staff member leaves the employment of Contractor in which case Contractor shall notify OCM and appoint an approved replacement as soon as reasonably possible. Contractor shall provide additional quality control, safety, and other staff as may be stated in the Contract Documents or as may be necessary or advisable for completion of the Work.

5.2.2 Labor. Contractor shall provide competent, suitably qualified personnel to survey, lay-out, and construct the Work as required by the Contract Documents and maintain good discipline and order at the Site at all times.

5.2.3 Services, Materials, and Equipment. Unless otherwise specified, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities, incidentals, and services necessary for the construction, performance, testing, start-up, inspection, and completion of the Work. The Contractor shall provide, without extra charge, all incidental items required as a part of the Work, even if not particularly specified or indicated in the Contract Documents.

5.2.4 No Substitutions without Approval. Contractor may make substitutions only with the consent of the Owner, after evaluation and recommendation by the Design Professional and in accordance with a Change Order.

5.3 Owner Equipment or Material. For Owner furnished equipment or material that will be in the care, custody, and control of Contractor, Contractor will be responsible for any damage or loss.

5.4 Non-Compliant Work. Should Design Professional and/or OCM identify Work as noncompliant with the Contract Documents, Design Professional and/or OCM shall communicate the finding to Contractor, and Contractor shall correct such Work at no additional cost to the Owner. The approval of Work by either Design Professional or OCM does not relieve Contractor from the obligation to comply with all requirements of the Contract Documents.

5.5 Subcontractors. Contractor shall not employ any Subcontractor, supplier, or other person or organization, whether initially or as a substitute, against whom Owner shall have reasonable objection. Owner will communicate such objections in writing within ten (10) days of receipt of Contractor’s intent to use such Subcontractor, supplier, or other person or organization. Contractor is not required to employ any Subcontractor, supplier, or other person or organization to furnish any of the work to whom Contractor has reasonable objection. Contractor shall not substitute Subcontractors without the acceptance of Owner.

5.5.1 Contract Documents. All Subcontracts and supply contracts shall be consistent with and bind the Subcontractors and suppliers to the terms and conditions of the Contract Documents including provisions of the Contract between Contractor and Owner.

5.5.2 Scheduling. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, suppliers, and other persons and organizations performing or
furnishing any of the Work under a direct or indirect contract or subcontract with Contractor. Contractor shall require all Subcontractors, suppliers, and such other persons and organizations performing or furnishing any of the Work to communicate with Owner only through Contractor. Contractor shall furnish to Owner a copy, at Owner’s request, of each first-tier subcontract promptly after its execution. Contractor agrees that Owner has no obligation to review or approve the content of such contracts and that providing Owner such copies in no way relieves Contractor of any of the terms and conditions of the Contract, including, without limitation, any provisions of the Contract which require the Subcontractor to be bound to Contractor in the same manner in which Contractor is bound to Owner.

5.6 Continuing the Work. Contractor shall carry on the Work and adhere to the progress schedule during all disputes, disagreements, or alternative resolution processes with Owner. Contractor shall not delay or postpone any Work because of pending unresolved disputes, disagreements, or alternative resolution processes, except as Owner and Contractor may agree in writing.

5.7 Cleaning. Contractor shall at all times, keep the Site and the Work clean and free from accumulation of waste materials or rubbish caused by the construction activities under the Contract. Contractor shall ensure that the entire Project is thoroughly cleaned prior to requesting Substantial Completion inspection and, again, upon completion of the Project prior to the final inspection.

5.8 Acts and Omissions of Contractor, its Subcontractors, and Employees. Contractor shall be responsible for acts and omissions of its employees and its Subcontractors and their agents and employees. Owner may, in writing, require Contractor to remove from the Project any of Contractor’s or its Subcontractor’s employees or agents whom OCM finds to be careless, incompetent, unsafe, uncooperative, disruptive, or otherwise objectionable.

5.9 Ancillary Areas. Contractor shall operate and maintain operations and associated storage areas at the site of the Work in accordance with the following:

- All Contractor operations, including storage of materials and employee parking upon the Site of Work, shall be confined to areas designated by OCM.
- Contractor may erect, at its own expense, temporary buildings that will remain its property. Contractor will remove such buildings and associated utility service lines upon completion of the Work, unless Contractor requests and Owner provides written consent that it may abandon such buildings and utilities in place.
- Contractor will use only established roadways or construct and use such temporary roadways as may be authorized by OCM. Contractor will not allow load limits of vehicles to exceed the limits prescribed by appropriate regulations or law. Contractor will provide protection to road surfaces, curbs, sidewalks, trees, shrubbery, sprinkler systems, drainage structures, and other like existing improvements to prevent damage and will repair any damage thereto at the expense of Contractor.
- Owner may restrict Contractor’s entry to the Site to specifically assigned entrances and routes.
5.10 **Off-Site Storage.** With prior approval by Owner and in the event Contractor elects to store materials at an off-site location, Contractor must abide by the following conditions, unless otherwise agreed to in writing by Owner:

- Store materials in a commercial warehouse meeting the criteria stated below.
- Provide insurance coverage adequate not only to cover materials while in storage, but also in transit from the off-site storage areas to the Project Site. Copies of duly authenticated certificates of insurance must be filed with Owner’s representative.
- Inspection by Owner’s representative is allowed at any time. OCM must be satisfied with the security, control, maintenance, and preservation measures.
- Materials for this Project must be physically separated and marked for the Project in a sectioned-off area. Only materials which have been approved through the submittal process are to be considered for payment.
- Owner reserves the right to reject materials at any time prior to final acceptance of the complete Contract if they do not meet Contract requirements regardless of any previous progress payment made.
- With each monthly payment estimate, Contractor must submit a report to OCM and Design Professional listing the quantities of materials already paid for and still stored in the off-site location.
- Contractor must make warehouse records, receipts, and invoices available to Owner’s representatives, upon request, to verify the quantities and their disposition.
- In the event of Contract termination or default by Contractor, the items in storage off-site, upon which payment has been made, will be promptly turned over to Owner or Owner’s agents in place or at a location near the jobsite as directed by OCM. The full provisions of performance and payment bonds on this Project cover the materials off-site in every respect as though they were stored on the Project Site.

5.11 **Separate Contracts.** Owner reserves the right to award other contracts in connection with the Project or other portions of the Project under the same or substantially similar contract conditions, including those portions related to insurance and waiver of subrogation. Owner reserves the right to perform operations related to the Project with Owner’s own forces.

5.11.1 **Continuation of Contract.** Under a system of separate contracts, the conditions described herein continue to apply except as may be amended by Amendment or Change Order.

5.11.2 **Cooperation.** Contractor shall cooperate with other contractors or forces employed on the Project by Owner, including providing access to Site, integration of activities within Contractor’s Work Progress Schedule and Project information as requested.

5.11.3 **Reimbursement.** Owner shall be reimbursed by Contractor for costs incurred by Owner which are payable to a separate contractor because of delays, improperly timed activities, or defective construction by Contractor. Owner will equitably adjust the Contract by Change Order for costs incurred by Contractor because of delays, improperly timed activities, damage to the Work, or defective construction by a separate contractor.
ARTICLE 6.
HISTORICALLY UNDERUTILIZED BUSINESS (HUB) SUBCONTRACTING PLAN

6.1 General Description. The purpose of the Historically Underutilized Business (HUB) program is to promote equal business opportunities for economically disadvantaged persons (as defined by Tex. Gov’t Code, Chapter 2161) to contract with the State of Texas in accordance with the goals specified in the State of Texas Disparity Study. The HUB program annual procurement utilization goals are defined in 34 T.A.C. § 20.13(b).

6.1.1 Good Faith Effort.

6.1.1.1 State agencies are required by statute to make a good faith effort to assist HUBs in participating in contract awards issued by the State. 34 T.A.C. § 20.13(b) outlines the State’s policy to encourage the utilization of HUBs in State contracting opportunities through race, ethnic, and gender neutral means.

6.1.1.2 A Contractor who contracts with the State in an amount of $100,000 or greater is required to make a good faith effort to award subcontracts to HUBs in accordance with 34 T.A.C. § 20.14(a)(2)(A) by submitting a HUB subcontracting plan within twenty-four (24) hours after the bid or response is due and complying with the HUB subcontracting plan after it is accepted by Owner and during the term of the Contract.

6.2 Compliance with Approved HUB Subcontracting Plan. Contractor, having been awarded this Contract in part by complying with the HUB program statute and rules, hereby covenants to continue to comply with the HUB program as follows:

- Prior to adding or substituting a Subcontractor, promptly notify Owner in the event a change is required for any reason to the accepted HUB subcontracting plan.
- Conduct the good-faith effort activities required, and provide Owner with necessary documentation to justify approval of a change to the approved HUB subcontracting plan.
- Cooperate in the execution of a Change Order or such other approval of the change in the HUB subcontracting plans as Contractor and Owner may agree to.
- Maintain and make available to Owner upon request business records documenting compliance with the accepted HUB subcontracting plan.
- Upon receipt of payment for performance of Work, submit to Owner a compliance report, in the format required by Owner that demonstrates Contractor’s performance of the HUB subcontracting plan.
- Submit monthly Progress Assessment Reports (PAR) to Owner, verifying compliance with the HUB subcontracting plan, including the use/expenditures made to Subcontractors. (The PAR is available at the following link: http://www.window.state.tx.us/procurement/prog/hub/hub-forms/.)
• Promptly and accurately explain and provide supplemental information to Owner to assist in Owner’s investigation of Contractor’s good-faith effort to fulfill the HUB subcontracting plan and the requirements under 34 T.A.C. § 20.14(a)(1).

6.3 Failure to Demonstrate Good-Faith Effort. Upon a determination by Owner that Contractor has failed to demonstrate a good-faith effort to fulfill the HUB subcontracting plan or any Contract covenant detailed above, Owner may, in addition to all other remedies available to it, report the failure to perform to the Comptroller of Public Accounts, Texas Procurement and Support Services Division, Historically Underutilized Business Program and may bar Contractor from future contracting opportunities with Owner.

ARTICLE 7.
BONDS

7.1 Construction Bonds. Contractor is required to tender to Owner, prior to commencing the Work, performance and payment bonds, as required by Tex. Gov’t Code, Chapter 2253.

7.2 Bond Requirements. Each bond shall be executed by a corporate surety or sureties authorized to do business in the State of Texas, acceptable to Owner, and in compliance with the relevant provisions of the Texas Insurance Code. If any bond is for more than ten percent (10%) of the surety’s capital and surplus, Owner may require certification that the company has reinsured the excess portion with one or more reinsurers authorized to do business in the State. A reinsurer may not reinsure for more than ten percent (10%) of its capital and surplus. If a surety upon a bond loses its authority to do business in the State, Contractor shall, within thirty (30) days after such loss, furnish a replacement bond at no added cost to Owner.

7.2.1 Performance Bonds. A Performance bond is required if the Contract Sum is in excess of $100,000. The performance bond is solely for the protection of Owner. The performance bond is to be for the Contract Sum to guarantee the faithful performance of the Work in accordance with the Contract Documents. For Design-Build Projects the performance bond is to be for the full amount of both the construction and design services in accordance with the Contract Documents. The form of the bond shall be approved by Owner. The performance bond shall be effective through Contractor’s warranty period.

7.2.2 Payment Bonds. A Payment bond is required if the Contract Sum is in excess of $25,000. The payment bond is to be for the Contract Sum and is payable to Owner solely for the protection and use of payment bond beneficiaries. For Design-Build Projects the payment bond is to be for the full amount of both the construction and design services in accordance with the Contract Documents. The form of the bond shall be approved by Owner.

7.2.3 When Bonds Are Due. Payment and performance bonds are due before Contractor commences any Work.

7.2.4 Power of Attorney. Each bond shall be accompanied by a valid power of attorney (issued by the surety company and attached, signed and sealed with the corporate embossed seal, to the bond) authorizing the attorney-in-fact who signs the bond to commit the company to
the terms of the bond, and stating any limit in the amount for which the attorney can issue a single bond.

7.3 **Bond Indemnification.** The process of requiring and accepting bonds and making claims thereunder shall be conducted in compliance with Tex. Gov’t Code, Chapter 2253. **IF FOR ANY REASON A STATUTORY PAYMENT OR PERFORMANCE BOND IS NOT HONORED BY THE SURETY, CONTRACTOR SHALL FULLY INDEMNIFY AND HOLD HARMLESS OWNER, AND ITS COMPONENT INSTITUTIONS, REGENTS, ELECTED AND APPOINTED OFFICIALS, DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, REPRESENTATIVES, AND VOLUNTEERS, FROM AND AGAINST ANY COSTS, LOSSES, OBLIGATIONS, OR LIABILITIES IT INCURS AS A RESULT.**

7.3.1 **Furnishing Bond Information.** Owner shall furnish certified copies of the payment bond and the related Contract to any qualified person seeking copies who complies with Tex. Gov’t Code § 2253.026.

7.3.2 **Claims on Payment Bonds.** Claims on payment bonds must be sent directly to Contractor and his surety in accordance with Tex. Gov’t Code § 2253.041. All payment bond claimants are cautioned that no lien exists on the funds unpaid to Contractor on such Contract, and that reliance on notices sent to Owner may result in loss of their rights against Contractor and/or his surety. Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no such responsibility because of any representation by any agent or employee.

7.4 **Payment of Claims when Payment Bond is Not Required.** The rights of Subcontractors regarding payment are governed by Tex. Prop. Code § 53.231 – 53.239 when the value of the Contract between Owner and Contractor is less than $25,000.00. These provisions set out the requirements for filing a valid lien on funds unpaid to Contractor as of the time of filing the claim, and actions necessary to release the lien and satisfaction of such claim.

7.5 **Sureties.** A surety shall be listed on the US Department of the Treasury’s Listing of Approved Sureties maintained by the Bureau of Financial Management Service (FMS), [www.fms.treas.gov/c570](http://www.fms.treas.gov/c570), stating companies holding Certificates of Authority as acceptable sureties on federal bonds and acceptable reinsuring companies (FMS Circular 570). The Owner will consider acceptable any corporate surety which is qualified under this paragraph and which has a rating of at least B in Best's Insurance Reports – Property – Casualty.

7.6 **Bond Costs.** The costs of bonds are a pass through amount to the Owner. No markup amounts are to be included and documentation of bond costs are required in requests for payment. Any costs associated with subcontractor bonds or SubGuard-related items are not paid by the Owner in General Conditions or Cost of Work.
ARTICLE 8.
INDEMNITY AND INSURANCE

8.1 Indemnification of Owner. Contractor covenants and agrees to FULLY INDEMNIFY and HOLD HARMLESS Owner, and its component institutions, Regents, elected and appointed officials, directors, officers, employees, agents, representatives, and volunteers, individually or collectively, from and against any and all costs, claims, liens, damages, losses, expenses, fees, fines, penalties, proceedings, actions, demands, causes of action, liability, and suits of any kind and nature, including but not limited to, personal or bodily injury, death, or property damage, made upon Owner directly or indirectly arising out of, resulting from, or related to Contractor’s activities under the Contract, including any acts or omissions of Contractor, or any director, officer, employee, agent, representative, consultant, or Subcontractor of Contractor, and their respective directors, officers, employees, agents, and representatives while in the exercise of performance of the rights or duties under the Contract. The indemnity provided for in this paragraph does not apply to any liability resulting from the negligence of Owner or separate contractors in instances where such negligence causes personal injury, death, or property damage. IN THE EVENT CONTRACTOR AND OWNER ARE FOUND JOINTLY LIABLE BY A COURT OF COMPETENT JURISDICTION, LIABILITY WILL BE APPORTIONED COMPARATIVELY IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS, WITHOUT WAIVING ANY GOVERNMENTAL IMMUNITY AVAILABLE TO THE STATE UNDER TEXAS LAW AND WITHOUT WAIVING ANY DEFENSES OF THE PARTIES UNDER TEXAS LAW.

8.1.1 No Third-Party Beneficiaries. The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

8.1.2 Notice. Contractor shall promptly advise Owner in writing of any claim or demand against Owner or against Contractor known to Contractor related to or arising out of Contractor’s activities under this Contract.

8.1.3 The indemnity provisions shall survive the termination of this Agreement regardless of the reason for termination

8.2 Insurance Requirements. Design Professional shall carry insurance in the types and amounts indicated in the Contract for the duration of the Contract. Unless otherwise provide for in the Contract, Contractor shall carry insurance in the types and amounts indicated in these Uniform General Conditions for the duration of the Contract. The insurance shall be evidenced by delivery to Owner of certificates of insurance executed by the insurer or its authorized agent stating coverage, limits, expiration dates, and compliance with all applicable required provisions. Upon request, Owner and its agents shall be entitled to receive, without expense, copies of the policies and all endorsements. Contractor shall update all expired policies prior to submission for monthly payment. Failure to update policies shall be reason for withholding of payment until renewal is provided to Owner.
8.2.1 **Period of Coverage.** Contractor, consistent with its status as an independent contractor, shall provide and maintain all insurance coverages with the minimum amounts described below until the end of the warranty period unless expressly agreed otherwise. Failure to maintain insurance coverage, as required, is grounds for suspension of Work for cause pursuant to Article 17.

8.2.2 **Certificates.** Contractor shall deliver to Owner true and complete copies of certificates and corresponding policy endorsements prior to the issuance of any Notice to Proceed.

8.2.3 **Failure to Provide Certificates.** Failure of Owner to demand such certificates or other evidence of Contractor’s full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

8.2.4 **Contractor’s Liability.** The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner in the Contract Documents.

8.2.5 **Insurance Limits.** The insurance coverage and limits established herein shall not be interpreted as any representation or warranty that the insurance coverage and limits necessarily will be adequate to protect Contractor.

8.2.6 **Insurers.** Coverage shall be written on an occurrence basis by companies authorized and admitted to do business in the State of Texas and rated A-, VII or better by A.M. Best Company or similar rating company or otherwise acceptable to Owner.

8.3 **Insurance Coverage Required.**

8.3.1 **Workers’ Compensation Insurance.** Coverage with limits as required by the Texas Workers’ Compensation Act, with the policy endorsed to provide a waiver of subrogation as to Owner, and Employer’s Liability Insurance of not less than:

- $1,000,000 each accident;
- $1,000,000 disease each employee; and
- $1,000,000 disease policy limit.

Workers’ compensation insurance coverage must meet the statutory requirements of Tex. Lab. Code § 401.011(44), and requirements specific to construction projects for public entities as required by Tex. Lab. Code § 406.096.

- Policies must include (a) Other States Endorsement to include TEXAS if business is domiciled outside the State of Texas, and (b) a waiver of all rights of subrogation in favor of Owner.

8.3.2 **Commercial General Liability Insurance.** Coverage including premises, operations, independent contractor’s liability, products, and completed operations and contractual liability, covering, but not limited to, the liability assumed under the indemnification provisions of this Contract, fully insuring Contractor’s (or Subcontractor’s) liability for bodily injury (including death) and property damage with a minimum limit of:
$1,000,000 per occurrence;
$2,000,000 general aggregate;
$5,000 Medical Expense each person;
$1,000,000 Personal Injury and Advertising Liability;
$2,000,000 products and completed operations aggregate;
$50,000 Damage to Premises Rented by You; and
Coverage shall be on an “occurrence” basis.
The policy shall include coverage extended to apply to completed operations and explosion, collapse, and underground hazards. The policy shall include endorsement CG2503 Amendment of Aggregate Limits of Insurance (per Project) or its equivalent.
If the Work involves any activities within fifty (50) feet of any railroad, railroad protective insurance as may be required by the affected railroad, written for not less than the limits required by such railroad.

8.3.3 Asbestos Abatement Liability Insurance. Coverage including coverage for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos containing materials. This requirement applies if the Work or the Project includes asbestos containing materials.

- The combined single limit for bodily injury and property damage will be a minimum of $1,000,000 per occurrence.
- Specific requirement for claims-made form: Required period of coverage will be determined by the following formula: continuous coverage for life of the Contract, plus one (1) year (to provide coverage for the warranty period), and an extended discovery period for a minimum of five (5) years which shall begin at the end of the warranty period.
- Employer’s liability limits for asbestos abatement will be:
  - $1,000,000 each accident;
  - $1,000,000 disease each employee; and
  - $1,000,000 disease policy limit.

8.3.4 Comprehensive Automobile Liability Insurance. Coverage covering owned, hired, and non-owned vehicles, with a minimum combined single limit for bodily injury (including death) and property damage of $1,000,000 per occurrence. No aggregate shall be permitted for this type of coverage.

- Such insurance is to include coverage for loading and unloading hazards.
- Contractor, or any subcontractor of Contractor, responsible for transporting asbestos or other hazardous materials defined as asbestos shall provide pollution coverage for any vehicle hauling asbestos containing cargo. The policy must include an MCS 90 endorsement with a $5,000,000 limit and the CA 9948 Pollution Endorsement, or its equivalent.
8.3.5 **All-Risk Builder’s Risk Insurance.** Coverage shall be all-risk (or all-risk installation floater for instances in which the project involves solely the installation of material and/or equipment), including, but not limited to, fire, extended coverage, vandalism and malicious mischief, theft and, if applicable, flood, earth movement and named storm. Builder’s risk and installation floater limits shall be equal to 100 percent of the Contract Sum plus, if any, existing property and Owner-furnished equipment specified by Owner. The policy shall be written jointly in the names of Owner and Contractor. Subcontractors shall be named as additional insureds. The policy shall have endorsements as follows:

- This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.
- This insurance shall not contain an occupancy clause suspending or reducing coverage should Owner partially occupy the Site and before the parties have determined Substantial Completion.
- Loss, if any, shall be adjusted with and made payable to Owner as trustee for the insureds as their interests may appear. Owner shall be named as loss payee.
- For renovation projects or projects that involve portions of Work contained within an existing structure, refer to Supplementary or Special Conditions for possible additional builder’s risk insurance requirements.
- For Owner furnished equipment or materials that will be in care, custody or control of Contractor, Contractor will be responsible for damage and loss.
- For those properties located within a Tier 1 or 2 windstorm area, named storm coverage must be provided with limits specified by Owner.
- For those properties located in flood prone areas, flood insurance coverage must be provided with limits specified by Owner.
- Builder’s risk insurance policy shall remain in effect until Substantial Completion.
- If this Contract is for asbestos abatement only, the foregoing All-Risk Builder’s Risk or All-Risk Installation Floater is not required.

8.3.6 **“Umbrella” Liability Insurance.** Coverage during the Contract term, insuring Contractor (or Subcontractor) that provides coverage at least as broad as and applies in excess and follows form of the primary liability coverage required above. The policy shall provide “drop down” coverage where underlying primary insurance coverage limits are insufficient or exhausted.

- “Umbrella” Liability Insurance coverage shall be for the following Contract amounts in the corresponding coverage amounts:

<table>
<thead>
<tr>
<th>Contract Amount</th>
<th>Occurrence</th>
<th>Annual Aggregate</th>
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<tr>
<td>&lt; $1,000,000</td>
<td>No Umbrella</td>
<td></td>
</tr>
<tr>
<td>$1,000,000 up to &lt; $3,000,000</td>
<td>$1,000,000</td>
<td>$2,000,000</td>
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<td>$10,000,000</td>
<td>$10,000,000</td>
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</table>
8.4 Policy Requirements. Policies must include the following clauses, as applicable:

- This insurance shall not be suspended, voided, canceled, materially changed, or non-renewed except after thirty (30) days, or ten (10) days for non-payment of premium, written notice has been given to Owner.
- It is agreed that Contractor’s insurance shall be deemed primary with respect to any insurance or self-insurance carried by Owner for liability arising out of operations under the Contract with Owner.
- Owner, its officials, directors, employees, representatives, and volunteers are added as additional insureds as respects operations and activities of, or on behalf of the named insured performed under the Contract with Owner. The additional insured status must cover completed operations as well. This is not applicable to workers’ compensation policies.
- A waiver of subrogation in favor of Owner shall be provided in all policies.
- If Owner is damaged by the failure of Contractor (or Subcontractor) to maintain insurance as required herein and/or as further described in Owner’s Special Conditions, then Contractor shall bear all reasonable costs properly attributable to that failure.

8.5 Subcontractor Insurance Coverage. WITHOUT LIMITING ANY OF THE OTHER OBLIGATIONS OR LIABILITIES OF CONTRACTOR, CONTRACTOR SHALL REQUIRE EACH SUBCONTRACTOR PERFORMING WORK UNDER THE CONTRACT TO MAINTAIN DURING THE TERM OF THE CONTRACT, THE SAME STIPULATED MINIMUM INSURANCE INCLUDING THE REQUIRED PROVISIONS AND ADDITIONAL POLICY CONDITIONS AS SHOWN ABOVE. AS AN ALTERNATIVE, CONTRACTOR MAY INCLUDE ITS SUBCONTRACTORS AS ADDITIONAL INSUREDs ON ITS OWN COVERAGE AS PRESCRIBED UNDER THESE REQUIREMENTS. CONTRACTOR’S CERTIFICATE OF INSURANCE SHALL NOTE IN SUCH EVENT THAT SUBCONTRACTORS ARE INCLUDED AS ADDITIONAL INSUREDs AND THAT CONTRACTOR AGREES TO PROVIDE WORKERS’ COMPENSATION FOR SUBCONTRACTORS AND THEIR EMPLOYEES. CONTRACTOR SHALL OBTAIN AND MONITOR THE CERTIFICATES OF INSURANCE FROM EACH SUBCONTRACTOR IN ORDER TO ASSURE COMPLIANCE WITH THE INSURANCE REQUIREMENTS. CONTRACTOR MUST RETAIN THE CERTIFICATES OF INSURANCE FOR THE DURATION OF THE CONTRACT PLUS FIVE (5) YEARS AND SHALL HAVE THE RESPONSIBILITY OF ENFORCING THESE INSURANCE REQUIREMENTS AMONG ITS SUBCONTRACTORS. OWNER SHALL BE ENTITLED, UPON REQUEST AND WITHOUT EXPENSE, TO RECEIVE COPIES OF THESE CERTIFICATES, CONSTRUCTION DOCUMENTS, COORDINATION DOCUMENTS, AND RECORD DOCUMENTS

ARTICLE 9
CONSTRUCTION DOCUMENTS, COORDINATION DOCUMENTS, AND RECORD DOCUMENTS
9.1 **Drawings and Specifications.**

9.1.1 **Copies Furnished.** Design Professional will furnish, free of charge, the number of complete sets of Drawings, Specifications, and addenda as provided in the Contract. Contractor will be furnished, free of charge, the number of complete sets of Drawings, Specifications, and addenda as provided in the Contract. Additional complete sets of Drawings and Specifications, if requested, will be furnished at reproduction cost to the one requesting such additional sets. Electronic copies of such documents will be provided to Contractor without charge.

9.1.2 **Ownership of Drawings and Specifications.** All Drawings, Specifications and copies thereof furnished by Design Professional shall be property of the Owner. These documents are not to be used by the Design Professional on any other project. Owner may use the Contract record set and electronic versions as needed for warranty operations or future renovations or additions without written approval of the Design Professional. All additional or confirmatory land survey field notes, sketches and related data, and additional or confirmatory soils engineering or investigations, samples, calculations, test results, and reports, for which Owner has paid for such direct services, shall be the sole property of Owner.

9.2 **Interrelation of Documents.** The Contract Documents as referenced in the Contract between Owner and Contractor are complimentary, and what is required by one shall be as binding as if required by all.

9.3 **Resolution of Conflicts in Documents.** Where conflicts may exist within the Contract Documents, the documents shall govern in the following order: (a) Change Orders or other written, signed amendments or addenda; (b) the Contract; (c) Uniform General Conditions; (d) Drawings; (e) Specifications (but Specifications shall control over Drawings as to quality of materials); and (f) other Contract Documents. Among other categories of documents having the same order of precedence, the term or provision that includes the latest date shall control. Contractor shall notify Design Professional and Owner for resolution of the issue prior to executing the Work in question.

9.4 **Contractor’s Duty to Review Contract Documents.** In order to facilitate Contractor’s responsibilities for completion of the Work in accordance with and as reasonably inferable from the Contract Documents, Contractor shall, prior to commencing the Work, examine and compare the Contract Documents, information furnished by Owner, relevant field measurements made by Contractor, and any visible or reasonably anticipated conditions at the Site affecting the Work. This duty extends throughout the design phase and construction phase prior to commencing each particular work activity and/or system installation. Updated Coordination Documents shall be provided to the Owner and Design Professional monthly.

9.5 **Discrepancies and Omissions in Drawings and Specifications.** Contractor shall immediately report to OCM and to Design Professional the discovery of any discrepancy, error, omission, or inconsistency in the Contract Documents prior to execution of the Work. When performing as a Construction Manager-at-Risk, Contractor has a shared responsibility with Design Professional for discovery and resolution of discrepancies, errors, omissions, and inconsistencies in the
Contract Documents. In such case, Contractor’s responsibility pertains to review, coordination, and recommendation of resolution strategies within budget constraints.

9.5.1 **Design-Build Firm.** It is recognized that Contractor is not acting in the capacity of a licensed design professional, unless it is performing as a Design-Build firm. When performing as a Design-Build firm, Contractor has sole responsibility for discrepancies, errors, and omissions in the Drawings and Specifications.

9.5.2 **Construction Manager-at-Risk Examination and Reporting.** When performing as a Construction Manager-at-Risk, Contractor has no liability for discrepancies, errors, omissions, or inconsistencies unless Contractor fails to immediately report in writing a discovered or apparent discrepancy, error, omission, or inconsistency to OCM and Design Professional. Should Contractor fail to perform the examination and reporting obligations of these provisions, Contractor is responsible for avoidable costs and direct and/or consequential damages.

9.5.3 **Other Limitations.** Unless Contractor is performing as a Design-Build Firm or a Construction Manager-at-Risk, Contractor’s examination of Contract Documents is to facilitate construction and does not create an affirmative responsibility to detect discrepancies, errors, omissions, or inconsistencies or to ascertain compliance with applicable laws, building codes, or regulations.

9.6 **No Warranty or Representation by Owner.** Owner makes no representations, express or implied, about the adequacy or accuracy of the Drawings, Specifications, or other Construction Documents provided or their suitability for their intended use. Owner expressly disclaims any implied warranty that the Construction Documents are adequate, accurate, or suitable for their intended use.

9.7 **Requirements for Record Documents.**

9.7.1 Contractor shall:

9.7.1.1 Maintain at the Site one copy of all Drawings, Specifications, addenda, approved submittals, Contract modifications, Change Orders, and all Project correspondence and one record copy of approved Shop Drawings, Samples, and similar required submittals.

9.7.1.2 Keep current and maintain Drawings and Specifications in good order with postings and markings to record actual conditions of Work, and show and reference all changes made during construction. Provide Owner and Design Professional access to these documents.

9.7.1.3 Keep current and maintain the record set of Drawings and Specifications which reflect the actual field conditions and representations of the Work performed, whether it be directed by addendum, Change Order, or otherwise. Make available all records prescribed herein for reference and examination by Owner and Design Professional, and their representatives and agents.
9.7.1.4 Be responsible for marking the Record Documents for all Contractor initiated documents and changes to the Contract Documents due to coordination and actual field conditions, including RFIs. During construction, update the Record Documents, including all related RFI’s, ASI’s CCD’s, and CO’s, at least monthly prior to submission of periodic partial pay estimates. Failure to maintain current Record Documents constitutes cause for denial of a progress payment otherwise due.

9.7.1.5 Within thirty (30) days of Substantial Completion, Contractor shall furnish the Design Professional a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties and like publications, or parts for all installed equipment, systems, and like items, and as described in the Contract Documents. A complete set must be provided to the Design Professional within seven (7) days of Final Completion.

9.7.2 Design Professional shall:

9.7.2.1 In coordination with Contractor, shall update Record Documents to accurately depict progress of the Work and “as-built” condition of the Project.

9.7.2.2 Be responsible for updating the Record Documents for any addenda, Change Orders, Design Professional supplemental instructions, and any other alterations to the Contract Documents generated by Design Professional or Owner. Design Professional shall provide Owner with an electronic copy of the Auto-CADD files, BIM files, and Record Documents in both native format and a reproducible format within thirty (30) days following Final Completion.

9.7.2.3 Upon final completion and as a condition of final payment, once Record Documents are determined acceptable by OCM and with input from the Contractor, provide one (1) reproducible copy and one (1) electronic media copy of all Record Documents incorporating all of the above requirements, unless required otherwise.

ARTICLE 10.
CONSTRUCTION SAFETY

10.1 General. It is the duty and responsibility of Contractor and all of its Subcontractors to be familiar with, enforce, and comply with all requirements of Public Law No. 91-596, 29 U.S.C. § 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto. Contractor shall prepare a safety plan specific to the Project and submit it to OCM and Design Professional prior to commencing Work. In addition, Contractor and all of its Subcontractors shall comply with all applicable laws and regulations of any public body having jurisdiction for safety
of persons or property to protect them from damage, injury, or loss and erect and maintain all necessary safeguards for such safety and protection.

10.2 **Notices.** Contractor shall provide notices as follows:

10.2.1 **Utilities and Adjacent Properties.** Notify owners of adjacent property, including those that own or operate utilities, utility services, and/or underground facilities, when prosecution of the Work may affect them or their facilities, and cooperate with them in the protection, removal, relocation and replacement, and access to their facilities and/or utilities.

10.2.2 **Material Safety Data Sheets.** Coordinate the exchange of material safety data sheets (MSDSs) or other hazard communication information required to be made available to or exchanged between or among employers at the site in connection with laws and regulations. Maintain a complete file of MSDSs for all materials in use on site throughout the construction phase and make such file available to Owner and its agents as requested.

10.3 **Emergencies.** In any emergency affecting the safety of persons or property, Contractor shall act to minimize, mitigate, and prevent threatened damage, injury, or loss. Contractor shall:

10.3.1 **On Call Response.** Have authorized agents of Contractor respond immediately upon call at any time of day or night when circumstances warrant the presence of Contractor to protect the Work or adjacent property from damage or to take such action pertaining to the Work as may be necessary to provide for the safety of the public.

10.3.2 **Notice.**

10.3.2.1 Give OCM and Design Professional prompt notice of all such events.

10.3.2.2 If Contractor believes that any changes in the Work or variations from Contract Documents have been caused by its emergency response, promptly notify Owner within twenty-four (24) hours of the emergency response event.

10.3.3 **Owner Remedy.** Should Contractor fail to respond, Owner is authorized to direct other forces to take action as necessary and Owner may deduct any cost of remedial action from funds otherwise due Contractor.

10.4 **Injuries.** In the event of an incident or accident involving outside medical care for an individual on or near the Work, Contractor shall notify OCM and other parties as may be directed promptly, but no later than twenty-four (24) hours after Contractor learns that an event required medical care. Contractor shall:

10.4.1 **Documentation.** Record the location of the event and the circumstances surrounding it, by using photography or other means, and gather witness statements and other documentation which describes the event.

10.4.2 **Incident Report.** Supply OCM and Design Professional with an incident report no later than thirty-six (36) hours after the occurrence of the event. In the event of a catastrophic incident (one (1) fatality or three (3) workers hospitalized), barricade and leave intact the
scene of the incident until all investigations are complete. A full set of incident investigation documents, including facts, finding of cause, and remedial plans shall be provided within one (1) week after occurrence, unless otherwise directed by legal counsel. Contractor shall provide OCM with written notification within one (1) week of such catastrophic event if legal counsel delays submission of full report.

10.5 Environmental Safety. Upon encountering any previously unknown potentially hazardous material, or other materials potentially contaminated by hazardous material, Contractor shall immediately stop work activities impacted by the discovery, secure the affected area, and notify OCM immediately.

10.5.1 Subcontractors. Contractor shall bind all Subcontractors to the same duty.

10.5.2 Owner. Upon receiving such notice, OCM will promptly engage qualified experts to make such investigations and conduct such tests as may be reasonably necessary to determine the existence or extent of any environmental hazard. Upon completion of this investigation, OCM will issue a written report to Contractor identifying the material(s) found and indicate any necessary steps to be taken to treat, handle, transport or dispose of the material.

10.5.2.1 Owner may hire third-party Contractors to perform any or all such steps.

10.5.2.2 Should compliance with OCM’s instructions result in an increase in Contractor’s cost of performance or delay the Work, upon Contractor’s submission of substantiated costs or an updated Work Progress Schedule and substantiated critical path analysis, Owner will make an equitable adjustment to the Contract Sum and/or the time of completion, and issue a Change Order accordingly.

10.6 Trenching Plan. When the project requires excavation which either exceeds a depth of four (4) feet, or results in any worker’s upper body being positioned below grade level, Contractor is required to submit a trenching plan to OCM prior to commencing trenching operations unless an engineered plan is part of the Contract Documents. The plan is required to be prepared and sealed by a professional engineer registered in the State of Texas and hired or employed by Contractor or Subcontractor to perform the work. Said engineer cannot be anyone who is otherwise either directly or indirectly engaged on this project.

ARTICLE 11.
QUALITY CONTROL

11.1 Materials & Workmanship. Contractor shall execute Work in a good and workmanlike matter in accordance with the Contract Documents. Contractor shall develop and provide a quality control plan specific to this Project and acceptable to Owner. Where Contract Documents do not specify quality standards, complete and construct all Work in compliance with generally accepted
construction industry standards. Unless otherwise specified, incorporate all new materials and equipment into the Work under the Contract.

11.2 Testing.

11.2.1 Owner. Owner is responsible for coordinating and paying for routine and special tests required to confirm compliance with quality and performance requirements, except as stated below or otherwise required by the Contract Documents.

11.2.2 Contractor shall provide the following testing:

11.2.2.1 Any test of basic material or fabricated equipment included as part of a submittal for a required item in order to establish compliance with the Contract Documents.

11.2.2.2 Any test of basic material or fabricated equipment offered as a substitute for a specified item on which a test may be required in order to establish compliance with the Contract Documents.

11.2.2.3 Preliminary, start-up, pre-functional, and operational testing of building equipment and systems as necessary to confirm operational compliance with requirements of the Contract Documents.

11.2.2.4 All subsequent tests on original or replaced materials conducted as a result of prior testing failure.

11.2.3 Standards. All testing shall be performed in accordance with standard test procedures by an accredited laboratory, or special consultant as appropriate, acceptable to Owner. Results of all tests shall be provided promptly to OCM, Design Professional, and Contractor.

11.2.4 Non-Compliance (Test Results). Should any of the tests indicate that a material and/or system does not comply with the Contract requirements, the burden of proof remains with Contractor, subject to:

11.2.4.1 Contractor selection and submission of the laboratory for Owner acceptance.

11.2.4.2 Acceptance by Owner of the quality and nature of tests.

11.2.4.3 All tests taken in the presence of Design Professional and/or OCM, or their representatives.

11.2.4.4 If tests confirm that the material/systems comply with Contract Documents, Owner will pay the cost of the test.

11.2.4.5 If tests reveal noncompliance, Contractor will pay those laboratory fees and costs of that particular test and all future tests, of that failing Work, necessary to eventually confirm compliance with Contract Documents.
11.2.4.6 Proof of noncompliance with the Contract Documents will make Contractor liable for any corrective action which OCM determines appropriate, including complete removal and replacement of noncompliant work or material.

11.2.5 Notice of Testing. Contractor shall give OCM and Design Professional timely notice of its readiness and the date arranged so OCM and Design Professional may observe such inspection, testing, or approval.

11.2.6 Test Samples. Contractor is responsible for providing Samples of sufficient size for test purposes and for coordinating such tests with the Work Progress Schedule to avoid delay.

11.2.7 Covering Up Work. If Contractor covers up any Work without providing Owner an opportunity to inspect, Contractor shall, if requested by OCM, uncover and recover the work at Contractor’s expense.

11.3 Submittals.

11.3.1 Contractor’s Submittals. Contractor shall submit with reasonable promptness consistent with the Project schedule and in orderly sequence all Shop Drawings, Samples, or other information required by the Contract Documents, or subsequently required by Change Order. Prior to submitting, Contractor shall review each submittal for general compliance with Contract Documents and approve submittals for review by Design Professional and Owner by an approval stamp affixed to each copy. Submittal data presented without Contractor’s stamp will be returned without review or comment, and any delay resulting from failure is Contractor’s responsibility.

11.3.1.1 Contractor shall within twenty-one (21) days of the effective date of the Notice To Proceed with construction, submit to OCM and Design Professional, a submittal schedule/register, organized by specification section, listing all items to be furnished for review and approval by Design Professional and Owner. The list shall include Shop Drawings, manufacturer literature, certificates of compliance, materials Samples, materials colors, guarantees, and all other items identified throughout the Specifications.

11.3.1.2 Contractor shall indicate the type of item, Contract requirements reference, and Contractor’s scheduled dates for submitting the item along with the requested dates for approval answers from Design Professional and Owner. The submittal register shall indicate the projected dates for procurement of all included items and shall be updated at least monthly with actual approval and procurement dates. Contractor’s Submittal Register must be reasonable in terms of the review time for complex submittals. Contractor’s submittal schedule must be consistent with the Work Progress Schedule and identify critical submittals. Show and allow a minimum of fifteen (15) days duration after receipt by Design Professional and OCM for review and approval. If re-submittal required, allow a minimum of an additional seven (7) days for review. Submit the updated Submittal Register with each request for progress.
payment. Owner may establish routine review procedures and schedules for submittals at the preconstruction conference and/or elsewhere in the Contract Documents. If Contractor fails to update and provide the Submittal Register as required, Owner may, after seven (7) days notice to Contractor withhold a reasonable sum of money that would otherwise be due Contractor.

11.3.1.3 Contractor shall coordinate the Submittal Register with the Work Progress Schedule. Do not schedule Work requiring a submittal to begin prior to scheduling review and approval of the related submittal. Revise and/or update both schedules monthly to ensure consistency and current project data. Provide to OCM the updated Submittal Register and schedule with each application for progress payment. Refer to requirements for the Work Progress Schedule for inclusion of procurement activities therein. Regardless, the Submittal Register shall identify dates submitted and returned and shall be used to confirm status and disposition of particular items submitted, including approval or other action taken and other information not conveniently tracked through the Work Progress Schedule.

11.3.1.4 By submitting Shop Drawings, Samples or other required information, Contractor represents that it has determined and verified all applicable field measurements, field construction criteria, materials, catalog numbers and similar data; and has checked and coordinated each Shop Drawing and Sample with the requirements of the Work and the Contract Documents.

11.3.2 Review of Submittals. Design Professional and OCM review is only for conformance with the design concept and the information provided in the Contract Documents. Responses to submittals will be in writing. The approval of a separate item does not indicate approval of an assembly in which the item functions. The approval of a submittal does not relieve Contractor of responsibility for any deviation from the requirements of the Contract unless Contractor informs Design Professional and OCM of such deviation in a clear, conspicuous, and written manner on the submittal transmittal and at the time of submission, and obtains Owner’s written specific approval of the particular deviation.

11.3.3 Correction and Resubmission. Contractor shall make any corrections required to a submittal and resubmit the required number of corrected copies promptly so as to avoid delay, until submittal approval. Direct attention in writing to Design Professional and OCM, when applicable, to any new revisions other than the corrections requested on previous submissions.

11.3.4 Limits on Shop Drawing Review. Contractor shall not commence any Work requiring a submittal until review of the submittal under Subsection 11.3.2. Construct all such work in accordance with reviewed submittals. Comments incorporated as part of the review in Subsection 11.3.2 of Shop Drawings and Samples is not authorization to Contractor to perform extra work or changed work unless authorized through a Change Order. Design Professional’s and OCM’s review, if any, does not relieve Contractor from responsibility
for defects in the Work resulting from errors or omissions of any kind on the submittal, regardless of any approval action.

11.3.5 No Substitutions without Approval. OCM and Design Professional may receive and consider Contractor’s request for substitution when Contractor agrees to reimburse Owner for review costs and satisfies the requirements of this section. If Contractor does not satisfy these conditions, OCM and Design Professional will return the request without action except to record noncompliance with these requirements. Owner will not consider the request if Contractor cannot provide the product or method because of failure to pursue the Work promptly or coordinate activities properly. Contractor’s request for a substitution may be considered by OCM and Design Professional when:

11.3.5.1 The Contract Documents do not require extensive revisions; and

11.3.5.2 Proposed changes are in keeping with the general intent of the Contract Documents and the design intent of Design Professional and do not result in an increase in cost to Owner; and

11.3.5.3 The request is timely, fully documented, properly submitted and one or more of the following apply:

- Contractor cannot provide the specified product, assembly or method of construction within the Contract Time;
- The request directly relates to an “or-equal” clause or similar language in the Contract Documents;
- The request directly relates to a “product design standard” or “performance standard” clause in the Contract Documents;
- The requested substitution offers Owner a substantial advantage in cost, time, energy conservation or other considerations, after deducting additional responsibilities Owner must assume;
- The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and OCM can approve the requested substitution;
- Contractor cannot provide the specified product, assembly or method of construction in a manner that is compatible with other materials and where Contractor certifies that the substitution will overcome the incompatibility;
- Contractor cannot coordinate the specified product, assembly or method of construction with other materials and where Contractor certifies they can coordinate the proposed substitution; or
- The specified product, assembly or method of construction cannot provide a warranty required by the Contract Documents and where Contractor certifies that the proposed substitution provides the required warranty.
• The manufacture of the specified product has been removed from production due to cancellation or obsolescence.

11.3.6 Unauthorized Substitutions at Contractor’s Risk. Contractor is financially responsible for any additional costs or delays resulting from unauthorized substitution of materials, equipment or fixtures other than those specified. Contractor shall reimburse Owner for any increased design or contract administration costs resulting from such unauthorized substitutions.

11.4 Field Mock-up. Mock-ups shall be constructed prior to commencement of a specified scope of work to confirm acceptable workmanship.

11.4.1 Minimum. As a minimum, field mock-ups shall be constructed for roofing systems, exterior veneer / finish systems, glazing systems, and any other Work requiring a mock-up as identified throughout the Contract Documents. Mock-ups for systems not part of the Project scope shall not be required.

11.4.2 No Incorporation Unless Approved. Mock-ups may be incorporated into the Work if allowed by the Contract Documents and if acceptable to OCM. If mock-ups are freestanding, they shall remain in place until otherwise directed by Owner.

11.4.3 Schedule. Contractor shall include field mock-ups in their Work Progress Schedule and shall notify OCM and Design Professional of readiness for review sufficiently in advance to coordinate review without delay.

11.5 Inspection During Construction. Contractor shall provide sufficient, safe, and proper facilities, including equipment as necessary for safe access, at all reasonable times for observation and/or inspection of the Work by Owner or Design Professional and their agents. Contractor shall not cover up any Work with finishing materials or other building components prior to providing Owner and Design Professional and their agents an opportunity to perform an inspection of the Work.

11.5.1 Corrected Work. Should corrections of the Work be required for approval, Contractor shall not cover up corrected Work until Owner indicates approval.

11.5.2 Owner’s Self Help. Should Contractor be unable to perform corrective work without impacting the overall WPS, Owner reserves the right to hire a separate Contractor to complete the correction. The cost of the correction performed by separate Contractor will be charged back to Contractor.

11.5.3 Notice. Contractor shall provide notification of at least five (5) working days or otherwise as mutually agreed, to OCM of the anticipated need for an inspection so that Contractor may proceed with cover-up of Work. Should OCM fail to make the necessary inspection within the agreed period, Contractor may proceed with cover-up Work, but is not relieved of responsibility for Work to comply with requirements of the Contract Documents.
ARTICLE 12.
CONSTRUCTION SCHEDULES

12.1 **Contract Time.** **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT.** The Contract Time is the time between the dates indicated in the Notice to Proceed for commencement of the Work and for achieving Substantial Completion. The Contract Time can be modified only by Change Order. Failure to achieve Substantial Completion within the Contract Time will cause damage to Owner and may subject Contractor to liquidated damages as provided in the Contract Documents. If Contractor fails to achieve Final Completion within thirty (30) days after Substantial Completion, Contractor shall be responsible for Owner’s additional inspection, project management, and maintenance cost to the extent caused by Contractor’s failure to achieve Final Completion.

12.2 **Notice to Proceed.** Owner will issue a Notice to Proceed which shall state the dates for commencing Work and for achieving Substantial Completion of the Work.

12.3 **Work Progress Schedule.** Refer to Division 1 of the Specifications for additional schedule requirements. Contractor shall submit for review and approval a Construction Baseline Schedule to Owner and Design Professional no later than twenty-one (21) days after the effective date of the Notice to Proceed with construction. The Construction Baseline Schedule shall indicate the dates for starting and completing the various aspects required to complete the work and shall utilize the Longest Path Method with fully editable logic. The schedule shall include mobilization, procurement, installation, testing, inspection, delivery of Close-out Documents, and acceptance of all Work. This Baseline Schedule shall become the comparison to the actual conditions throughout the Contract duration and become a part of the Work Progress Schedule (WPS). Contractor shall coordinate and integrate the Work Progress Schedule with the services and activities of Owner, Contractor, Design Professional, other consultants/suppliers, subcontractors and the requirements of governmental entities.

This section applies to construction phase Work Progress Schedules. Requirements for design phase scheduling for Construction Manager-at-Risk and Design Build contracts are outlined in the specific agreements.

12.3.1 **Work Progress Schedule Updates.**

12.3.1.1 Contractor shall update the Work Progress Schedule and the Submittal Register weekly during the Owner/Architect/Contractor (OAC) meetings, at a minimum, to reflect progress to date and current plans for completing the Work, while maintaining the Baseline Schedule, and shall submit electronic and paper copies of the update to Design Professional and OCM as directed but at a minimum with each request for payment. Owner has no duty to make progress payments unless accompanied by the updated Work Progress Schedule.

12.3.1.2 Contractor should revise the Work Progress Schedule as necessary or appropriate for the management of the Work. All updated Work Progress
Schedules must show the anticipated date of completion and reflect all extensions of time granted through Change Order as of the date of the update.

12.3.1.3 Contractor shall identify all proposed changes to schedule logic to Owner and to Design Professional via an executive summary accompanying the updated Work Progress Schedule for review and approval prior to implementation of any revisions to the Work Progress Schedule. Schedule changes that materially impact Owner’s operations shall be communicated within forty-eight (48) hours to OCM.

12.3.1.4 The Work Progress Schedule constitutes Contractor’s representation to Owner of the accurate depiction of all progress to date and that Contractor will follow the schedule as submitted in performing the Work.

12.3.2 Use of Work Progress Schedules. The Work Progress Schedule is for Contractor’s use in managing the Work and submittal of the Work Progress Schedule, and successive updates or revisions, is for the information of Owner and to demonstrate that Contractor has complied with requirements for planning and completing the Work.

12.3.2.1 Owner will coordinate its own activities with Contractor’s activities as shown on the Work Progress Schedule.

12.3.2.2 Owner’s review of the Work Progress Schedule, or update or revision, does not indicate any approval of Contractor’s proposed sequences and duration.

12.3.2.3 Owner’s review of a Work Progress Schedule update or revision indicating early or late completion does not constitute Owner’s consent, alter the terms of the Contract, or waive either Contractor’s responsibility for timely completion or Owner’s right to damages for Contractor’s failure to so do.

12.3.2.4 Contractor’s scheduled dates for completion of any activity or the entire Work do not constitute a change in terms of the Contract. Change Orders are the only method of modifying the Substantial Completion Date(s) and Contract Time.

12.4 Ownership of Float. Unless indicated otherwise in the Contract Documents, Contractor shall develop its schedule, pricing, and execution plan to provide a minimum of ten percent (10%) total float at acceptance of the Baseline Schedule. Float time contained in the Work Progress Schedule is not for the exclusive benefit of Contractor or Owner, but belongs to the Project and may be consumed by either party. Before Contractor uses any portion of the float, Contractor must submit a written request to Owner and receive Owner’s written authorization to use the portion of float. Owner’s approval will not unreasonably be withheld.

12.5 Completion of Work. Contractor is responsible and accountable for completing the Work within the Contract Time stated in the Contract, or as otherwise amended by Change Order.
12.5.1 **Owner’s Self Help.** Should Contractor be unable to complete portion of Work, Owner may hire separate Contractor to complete these items. The cost to complete this Work will be charged back to Contractor.

12.5.2 **Requirement to Regain Schedule.** If, in the judgment of Owner, the Work is behind schedule and the rate of placement of Work is inadequate to regain scheduled progress to insure timely completion of the entire Work or a separable portion thereof, Contractor, when so informed by Owner, shall immediately take action to increase the rate of Work placement by:

12.5.2.1 An increase in working forces.

12.5.2.2 An increase in equipment or tools.

12.5.2.3 An increase in hours of work or number of shifts.

12.5.2.4 Expedited delivery of materials.

12.5.2.5 Other action proposed if acceptable to Owner.

12.5.3 **Recovery Schedule.** Within ten (10) days after such notice, Contractor shall notify OCM in writing of the specific measures taken and/or plan to increase the rate of progress. Contractor shall include an estimate as to the date of scheduled progress recovery and an updated Work Progress Schedule illustrating Contractor’s plan for achieving timely completion of the Work. Should Owner deem the plan of action inadequate, Contractor shall take additional steps or make adjustments as necessary to its plan of action until it meets with Owner’s approval.

12.5.4 **Owner’s Notice Not Acceleration.** Owner’s notice to Contractor shall not be considered acceleration by Owner and Owner shall not be responsible for any increased costs incurred by Contractor.

12.6 **Modification of the Contract Time.** Delays and extensions of Contract Time are valid only if properly noticed and documented by Change Order.

12.6.1 **Extension Request.** When a delay is an Excusable Delay, and such delay prevents Contractor from completing the Work within the Contract Time, Contractor may be granted an extension of Contract Time. Owner will extend Contract Time by the number of days lost due to Excusable Delay, as measured by a substantiated critical path analysis of the Work Progress Schedule; provided, however, in no event will an extension of Contract Time be granted for delays that merely extend the duration of non-critical activities, or concurrent delay or which only consume float. All extensions of Contract Time will be granted in calendar days.

12.6.2 **Weather Day.** “Weather Days” means days contained in the Baseline Schedule that are reasonably foreseeable adverse weather conditions and will not constitutes an Excusable Delay. For purposes of the Agreement, “reasonably foreseeable adverse weather
conditions” means weather conditions in keeping with the historical average listed by the National Oceanic and Atmospheric Administration on its website, www.noaa. When a Weather Day prevents critical path activities at the site from proceeding, Contractor shall: (a) immediately notify OCM for confirmation of the conditions and provide a detailed list of critical path activities impacted; and (b) at the end of each calendar month, submit to OCM and Design Professional a list of Weather Days occurring in that month along with documentation of the impact on critical path activities. Based on substantiated critical path analysis to the Work Progress Schedule, Owner will issue a Weather Day Confirmation for any Contract Time extension to be documented by Change Order.

12.6.3 **Excusable Delay.** An “Excusable Delay” is a delay to Contractor’s current schedule caused by circumstances listed below that prevents Contractor from completing the Work within the Contract Time. Based on substantiated critical path analysis to the Work Progress Schedule, any Contract Time extension will be issued by Change Order. Excusable Delay may be caused by the following:

12.6.3.1 Discrepancies, errors, omissions, and inconsistencies in design, which Design Professional corrects by means of changes in the Drawings and Specifications; provided, however, that this does not apply if (a) Contractor is a Design-Build Firm, or (b) Contractor is a Construction Manager-at-Risk and failed to promptly report a discovered or apparent discrepancy, error, omission, or inconsistency during the pre-construction phase.

12.6.3.2 Unanticipated physical conditions at the Site, which Design Professional corrects by means of changes to the Drawings and Specifications or for which ODR directs changes in the Work identified in the Contract Documents.

12.6.3.3 Changes in the Work that delay activities identified in Contractor’s Work Progress Schedule as “critical” to completion of the entire Work, if such changes are directed by ODR or recommended by Design Professional and directed by ODR.

12.6.3.4 Suspension of Work for unexpected natural events, civil unrest, strikes or other events which are not within the reasonable control of Contractor.

12.6.3.5 Suspension of Work for convenience of Owner, which prevents Contractor from completing the Work within the Contract Time.

12.7 **No Damages for Weather Days.** An extension of Contract Time shall be the sole remedy of Contractor for delays in performance of the Work due to Weather Days, and Contractor shall not be entitled to any compensation or recovery of any direct or indirect costs or damages.

12.8 **Costs for Excusable Delay.** In the event that Contractor incurs additional direct costs because of an Excusable Delay (other than described in Subsection 12.6.3.4) within the reasonable control of Owner, in addition to an extension of Contract Time the Contract Sum will be equitably adjusted by Owner pursuant to the provisions of Article 14.
12.9 **No Damages for Other Delay.** Except for direct costs for Excusable Delay as provided above, Contractor has no claim for monetary damages for delay or hindrances to the Work from any cause, whether or not such delays are foreseeable, except for delays caused solely by acts of Owner that constitute intentional interference with Contractor’s performance of the Work and then only to the extent such acts continue after Contractor notifies Owner in writing of such interference. For delays caused by any act other than the sole intentional interference of Owner that continues after notice, Contractor shall not be entitled to any compensation or recovery of any damages including, without limitation, direct and indirect costs, consequential damages, lost opportunity costs, impact damages, loss of productivity, or other similar damages. Owner’s exercise of any of its rights or remedies under the Contract including, without limitation, ordering changes in the Work or directing suspension, rescheduling, or correction of the Work, shall not be construed as intentional interference with Contractor’s performance of the Work regardless of the extent or frequency of Owner’s exercise of such rights or remedies.

12.10 **Concurrent Delay.** Notwithstanding anything herein to the contrary, when the completion of the Work is simultaneously delayed by a Weather Day or an Excusable Delay and a delay arising from a cause not designated as excusable, Contractor will not be entitled to an extension of Contract Time for the period of concurrent delay.

12.11 **Time Extension Requests for Changes to the Work or Excusable Delay.** Extensions to Contract Time requested in association with changes to the Work directed or requested by Owner shall be included with Contractor’s proposed costs for such change. If Contractor believes that the completion of the Work is delayed by Excusable Delay, Contractor shall give OCM written notice, stating the nature of the delay and the activities potentially affected, within five (5) days after the onset of the event or circumstance giving rise to the Excusable Delay. Contractor shall provide sufficient written evidence to document the Excusable Delay. In the case of a continuing cause of delay, only one claim is necessary. Claims for extensions of time should be made in numbers of whole or half days.

12.11.1 **Content of Request.** Within ten (10) days after the cessation of the Excusable Delay, Contractor shall formalize in writing its request for extension of Contract Time to include substantiation of the excusable nature of the delay and a complete analysis of impact to critical path activities. Based on substantiated critical path analysis to the Work Progress Schedule, any Contract Time extension granted will be issued by Change Order.

12.11.2 **No Release.** No extension of time releases Contractor or the Surety furnishing a performance or payment bond from any obligations under the Contract or such a bond. Those obligations remain in full force until the discharge of the Contract.

12.11.3 **Longest Path Analysis.** Contractor shall provide with each Time Extension Request a quantitative demonstration of the impact of the delay on completion of the Work and Contract Time, based on the Work Progress Schedule. Contractor shall include with Time Extension Requests a reasonably detailed narrative setting forth:
12.11.3.1 The nature of the delay and its cause due to a change in the Work or an Excusable Delay and the basis of Contractor’s claim of entitlement to an extension of Contract Time.

12.11.3.2 Documentation of the actual impacts of the claimed delay on the Longest Path in Contractor’s Work Progress Schedule, and any concurrent delays.

12.11.3.3 Description and documentation of steps taken by Contractor to mitigate the effect of the claimed delay, including, when appropriate, the modification of the Work Progress Schedule.

12.11.4 Owner Response. Owner will respond to the Time Extension Request by providing to Contractor written notice of the number of days granted, if any, and giving its reason if this number differs from the number of days requested by Contractor.

12.11.4.1 Owner will not grant time extensions for delays that do not affect the Contract Substantial Completion date.

12.11.4.2 Owner will respond to each properly submitted Time Extension Request within a reasonable time following receipt. If Owner does not have enough information to make a determination or cannot reasonably make a determination within forty-five (45) days, Owner will notify Contractor in writing.

12.12 Failure to Complete Work in the Contract Time. TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT. Contractor’s failure to achieve substantial completion by the Contract Time or to achieve Substantial Completion as required will cause damage to Owner. These damages shall be liquidated by agreement of Contractor and Owner, in the amount per day as set forth in Section 12.13 below or elsewhere in the Contract Documents.

12.13 Liquidated Damages. Unless otherwise stated in the Contract, for each consecutive calendar day beyond the Contract Time that Substantial Completion of the Work is not achieved, Contractor shall pay Owner, within ten (10) days following written demand, an amount determined by the following schedule:

<table>
<thead>
<tr>
<th>Project Cost</th>
<th>Liquidated Damages</th>
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<tbody>
<tr>
<td>From To</td>
<td>Per Day</td>
</tr>
<tr>
<td>&lt; $1,000,000</td>
<td>$250</td>
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<tr>
<td>$1,000,000</td>
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<tr>
<td>&gt; $100,000,000</td>
<td>$10,000</td>
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</table>
12.13.2 **Reasonable Estimate.** Not as a penalty but as liquidated damages representing the parties’ estimate at the time of Contract execution of the damages that Owner will sustain for late Substantial Completion of Work. The parties stipulate and agree that the actual damages sustained by Owner for late Substantial Completion of the Work will be uncertain and difficult to ascertain, that calculating Owner’s actual damages would be impractical, unduly burdensome, and cause unnecessary delay, and that the amount of daily liquidated damages set forth above is a reasonable estimate.

12.13.3 **Offset.** Owner may also recover the liquidated damages from any money due or that becomes due Contractor. The amount of liquidated damages may be adjusted by the terms of the Contract.

12.13.4 **No Waiver.** Payment or offset of the liquidated damages does not preclude recovery under the Contract, except for claims related to delays in Substantial Completion or Final Completion. Owner’s right to receive liquidated damages shall not affect Owner’s right to terminate the Contract as provided in these Uniform General Conditions or elsewhere in the Contract Documents, nor shall termination of the Contract release Contractor from the obligation to pay liquidated damages.

**ARTICLE 13.**

**PAYMENTS**

13.1 **Job Order Contracts.** Contractor shall submit to OCM pricing based on the regional RS Means or Gordian Group pricing. The Job Order may be a fixed price, lump-sum contract based on unit pricing applied to estimated quantities or unit price order based on the quantities and line items delivered and the coefficient applied to the work items.

13.2 **Schedule of Values (utilized in CMAR and GCA).** Contractor shall submit to OCM and Design Professional for acceptance a Schedule of Values accurately itemizing material and labor for the various classifications of the Work based on the organization of the specification sections and of sufficient detail acceptable to OCM. The accepted Schedule of Values will be the basis for the progress payments under the Contract.

13.2.1 **Requirements.**

13.2.1.1 No progress payments will be made prior to receipt and acceptance of the Schedule of Values, provided in such detail as required by OCM, and submitted not less than twenty-one (21) days after the effective date of the Notice to Proceed. The Schedule of Values shall follow the order of trade divisions of the Specifications and include itemized costs for General Conditions, costs for preparing Close-Out Documents, fees, contingencies, and Owner cash allowances, if applicable, so that the sum of the items will equal the Contract Sum. As appropriate, assign each item labor and/or material
values, the subtotal thereof equaling the value of the Work in place when complete.

13.2.1.2 Owner requires that the Work items be inclusive of the cost of the Work items only. Any contract markups for overhead and profit, General Conditions, etc., shall be contained within separate line items for those specific purposes which shall be divided into at least two (2) lines, one (1) for labor and one (1) for materials.

13.2.1.3 Contractor shall retain a copy of all worksheets used in preparation of its bid or proposal, supported by a notarized statement that the worksheets are true and complete copies of the documents used to prepare the bid or proposal, and shall make the worksheets available to Owner at the time of Contract execution. Thereafter, Contractor shall grant Owner during normal business hours access to said copy of worksheets at any time during the period commencing upon execution of the Contract and ending one (1) year after final payment.

13.3 Progress Payments. Contractor will receive periodic progress payments for Work performed, materials in place, suitably stored on Site, or as otherwise agreed to by Owner and Contractor. Payment is not due until receipt by Owner or its designee of a correct and complete Pay Application in electronic and/or hard copy format as required by the Contract Documents, and certified by Design Professional. Progress payments are made provisionally and do not constitute acceptance of Work not in accordance with the Contract Documents. Owner will not process progress payment applications for Change Order Work until all parties execute the Change Order.

13.3.1 Preliminary Pay Worksheet. Once each month that a progress payment is to be requested, the Contractor shall submit to Design Professional and OCM a complete, clean copy of a preliminary pay worksheet or preliminary pay application, to include the following:

13.3.1.1 Contractor’s estimate of the amount of Work performed, labor furnished, and materials incorporated into the Work, using the established Schedule of Values;

13.3.1.2 An updated Work Progress Schedule reflecting progress of Work, including the executive summary and all required schedule reports. The progress of Work shall be the same progress as payment request;

13.3.1.3 HUB subcontracting plan Progress Assessment Report;

13.3.1.4 Reimbursable expenses incurred solely and directly in support of the Project within one of the following categories:

- Travel expenditures at State of Texas reimbursement rates, provided that reimbursement will not be granted for travel 1) within the Denton-Dallas-Fort Worth area or 2) involving less than 150 miles round-trip; or
• Reproductions, printing, printing supplies, plotting, photographs, renderings, postage, binding, collating, delivery and handling of reports; Drawings and Specifications or other project-related work product other than that used solely in-house by Contractor at actual expense incurred; or

• Fees and associated reimbursable expenses paid to Consultants hired in accordance with prior written approval from Owner.

• Expenses excluded from reimbursement include telephone charges, FAX services, alcoholic beverages, laundry service, valet service, entertainment expenses and any non-Project related items.

• Reimbursement of tips shall not exceed fifteen percent (15%).

13.3.1.5 Such additional documentation as Owner may require in the Contract Documents; and

13.3.1.6 Construction payment affidavit.

13.3.2 Contractor’s Application for Payment. As soon as practicable, but in no event later than seven (7) days after receipt of the preliminary pay worksheet, Design Professional and OCM will meet with Contractor to review the preliminary pay worksheet and to observe the condition of the Work. Based on this review, OCM and Design Professional may require modifications to the preliminary pay worksheet prior to the submittal of an Application for Payment, and will promptly notify Contractor of revisions necessary for approval. As soon as practicable, Contractor shall submit its Application for Payment on the appropriate and completed form, reflecting the required modifications to the Schedule of Values required by Design Professional and/or OCM, and must attach all additional documentation required by OCM and/or Design Professional, as well as an affidavit affirming that all payrolls, bills for labor, materials, equipment, subcontracted work, and other indebtedness connected with Contractor’s Application for Payment are paid or will be paid within the time specified in Tex. Gov’t Code, Chapter 2251. No Application for Payment is complete unless it fully reflects all required modifications, and attaches all required documentation including Contractor’s affidavit.

13.3.3 Certification by Design Professional. Within five (5) days or earlier following Design Professional’s receipt of Contractor’s formal Application for Payment, Design Professional will review the Application for Payment for completeness, and forward it to OCM. Design Professional will certify that the application is complete and payable, or that it is incomplete, stating in particular what is missing. If the Application for Payment is incomplete, Contractor shall make the required corrections and resubmit the Application for Payment for processing.

13.4 Owner’s Duty to Pay. Owner has no duty to pay the Contractor except on receipt by OCM of: (a) a complete Application for Payment certified by Design Professional; and (b) Contractor’s updated Work Progress Schedule.
13.4.1 **Stored Materials.** Payment for stored materials and/or equipment confirmed by Owner and Design Professional to be on-site or otherwise properly stored is limited to eighty-five percent (85%) of the invoice price or eighty-five percent (85%) of the scheduled value for the materials or equipment, whichever is less.

13.4.2 **Retainage.** Owner will withhold from each progress payment, as retainage, whichever is more of the following three options: (a) five percent (5%) of the total earned amount; (b) the amount authorized by law; or (c) as otherwise set forth in the Contract Documents. Retainage will be managed in conformance with Tex. Gov’t Code, Chapter 2252, Subchapter B.

13.4.2.1 Contractor shall provide written consent of its surety and concurrence of Design Professional for any request for reduction or release of retainage.

13.4.2.2 At least sixty-five percent (65%) of the Contract, or such other discrete Work phase as set forth in Subsection 15.1.6 or Work package delineated in the Contract Documents, must be completed before Owner can consider a retainage reduction or release, and only if permissible by law.

13.4.2.3 Contractor shall not withhold retainage from its Subcontractors and suppliers in amounts that are any percentage greater than that withheld in its Contract with Owner under this subsection, unless otherwise acceptable to Owner.

13.4.3 **Price Reduction to Cover Loss.** Owner may reduce any Application for Payment, prior to payment to the extent necessary to protect Owner from loss on account of actions of Contractor including, but not limited to, the following:

13.4.3.1 Defective or incomplete Work not remedied;

13.4.3.2 Damage to Work of a separate Contractor;

13.4.3.3 Failure to maintain scheduled progress;

13.4.3.4 Reasonable evidence provided with Work Progress Schedule that the Work will not be completed within the Contract Time;

13.4.3.5 Persistent failure to carry out the Work in accordance with the Contract Documents;

13.4.3.6 Reasonable evidence that the Work cannot be completed for the unpaid portion of the Contract Sum;

13.4.3.7 Assessment of fines for violations of prevailing wage rate law; or

13.4.3.8 Failure to include the appropriate amount of retainage for that periodic progress payment.
13.4.4 Title.

13.4.4.1 Title to all material and Work covered by progress payments transfers to Owner upon payment.

13.4.4.2 Transfer of title to Owner does not: (a) relieve Contractor and its Subcontractors of the sole responsibility for the care and protection of materials and Work upon which payments have been made until final acceptance; (b) diminish the responsibility of Contractor and its Subcontractors to restore any damaged Work; or (c) waive the right of Owner to require the fulfillment of all the terms of the Contract.

13.4.5 Contracts with No Payment Bond. For a Contract in any amount less than $25,000.00, payment will be made in one lump sum at the Final Completion of the Work, including Punch list items and change orders.

13.4.6 No Release. Progress payments to Contractor do not release Contractor or its surety from any obligations under the Contract.

13.4.7 Documentation.

13.4.7.1 Upon Owner’s request, Contractor shall furnish manifest proof of the status of Subcontractor's accounts in a form acceptable to Owner.

13.4.7.2 Pay estimate certificates must be signed by a corporate officer or a representative duly authorized by Contractor.

13.4.7.3 Provide copies of bills of lading, invoices, delivery receipts, or other evidence of the location and value of such materials in requesting payment for materials. For purposes of Tex. Gov't Code § 2251.021(a)(2), the date the performance of service is complete is the date when ODR approves the Application for Payment.

13.5 Time for Payment by Contractor Pursuant to Tex. Gov't Code § 2255.022. Upon Contractor's receipt of payment from Owner, Contractor shall pay Subcontractor the appropriate share of the payment not later than the tenth (10th) day after the date the Contractor receives the payment. The appropriate share is overdue on the eleventh (11th) day after the date Contractor receives the payment.

ARTICLE 14.

CHANGES

14.1 Change Orders. A Change Order issued after execution of the Contract is a written order to Contractor, signed by ODR, Contractor, and Design Professional, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time can only be changed by Change Order. A Change Order signed by Contractor
indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. ODR may issue a written authorization for Contractor to proceed with Work of a Change Order in advance of final execution by all parties in accordance with Section 14.9 or other contract provisions.

14.1.1 **Owner Ordered Changes.** Owner, without invalidating the Contract and without approval of Contractor’s Surety, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, and the Contract Sum and the Contract Time will be adjusted accordingly. All such changes in the Work shall be authorized by Change Order or CCD, and shall be performed under the applicable conditions of the Contract Documents. If such changes cause an increase or decrease in Contractor’s cost of, or time required for, performance of the Work, an adjustment to Contract Sum or Contract Time shall be made and authorized by a Change Order.

14.1.2 **Corrections.** It is recognized by the parties hereto and agreed by them that the Drawings and Specifications may not be complete or free from discrepancies, errors, omissions, or inconsistencies, or that they may require changes or additions in order for the Work to be completed to the satisfaction of Owner. Accordingly, it is the express intention of the parties, notwithstanding any other provisions in this Contract, that any discrepancies, errors, omissions, or inconsistencies in such Drawings and Specifications, or any changes in or additions to Drawings and Specifications or to the Work ordered by Owner and any resulting delays in the Work or increases in Contractor’s costs and expenses arising out of such discrepancies, errors, omissions, or inconsistencies shall not constitute or give rise to any claim, demand, or cause of action of any nature whatsoever in favor of Contractor, whether for breach of Contract, or otherwise. However, that Contractor will be entitled to the time or sum stated to be due Contractor in any Change Order approved and signed by all parties, which shall constitute full compensation to Contractor for all costs, expenses, and damages to Contractor.

14.2 **Unit Prices.** If unit prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed in a Proposed Change Order that application of the agreed unit prices to the quantities of work proposed will cause substantial inequity to Owner or Contractor, the applicable unit prices shall be equitably adjusted as agreed to by the parties and incorporated into a Change Order.

14.2.1 **Job Order Unit Prices.** Job Order Unit Prices as stated in the contract document or Proposed Change Order shall be based upon a regional RS Means Book or Gordian Group pricing.

14.3 **Claims for Additional Costs.**

14.3.1 **Claim with no Requested Change.** If Contractor wishes to make a claim for an increase in the Contract Sum not related to a requested change, Contractor shall give Owner and Design Professional written notice thereof within twenty-one (21) days after the occurrence of the event giving rise to such claim, but, in any case before proceeding to execute the Work considered to be additional cost or time, except in an emergency endangering life or
property in which case Contractor shall act in accordance with Section 10.3. No such claim shall be valid unless so made. If Owner and Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined as set forth under Article 18. Any change in the Contract Sum resulting from such claim must be authorized by a Change Order.

14.3.2 **Miscellaneous Claims.** If Contractor claims that additional cost is involved because of, but not limited to: (1) any written interpretation of the Contract Documents; (2) any order by Owner to stop the Work pursuant to Article 17 where Contractor was not at fault; or (3) any written order for a minor change in the Work issued pursuant to Section 14.4, Contractor shall make such claim as provided in Section 14.3.1.

14.3.3 **Failure to Notify.** Should Contractor fail to call to the attention of Owner and Design Professional to discrepancies, errors, omissions, or inconsistencies in the Contract Documents, but claim additional costs for corrective Work after Contract award or after Owner’s acceptance of Contractor’s Construction Manager-at-Risk guaranteed maximum price, Owner may assume intent to circumvent competitive bidding for the necessary corrective Work. In such case, Owner may choose to let a separate Contract for the corrective Work, or issue a CCD to require performance by Contractor. Claims for time extensions or for extra cost resulting from delayed notice of patent Contract Document discrepancies, errors, omissions, or inconsistencies will not be considered by Owner.

14.4 **Minor Changes.** Design Professional, with concurrence of OCM, will have authority to order minor changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time. Such changes shall be effected by written order which Contractor shall carry out promptly and record on as-built Record Documents.

14.5 **Concealed Site Conditions.** Contractor is responsible for visiting the Site and being familiar with local conditions such as the location, accessibility, and general character of the Site and/or building. If, in the performance of the Contract, subsurface, latent, or concealed conditions at the Site are found to be materially different from the information included in the Contract Documents, or if unknown conditions of an unusual nature are disclosed differing materially from the conditions usually inherent in Work of the character shown and specified, OCM and Design Professional shall be notified in writing of such conditions before they are disturbed. Upon such notice, or upon its own observation of such conditions, Design Professional, with the approval of ODR, will promptly make such changes in the Drawings and Specifications as deemed necessary to conform to the different conditions. Any increase or decrease in the cost of the Work, or in the time within which the Work is to be completed, resulting from such changes will be adjusted by Change Order.

14.6 **Extension of Time.** All changes to the Contract Time made as a consequence of requests as required in the UGC’s, must be documented by Change Order.
14.7 **Administration of Change Order Requests.** All changes in the Contract shall be administered in accordance with procedures approved by Owner, and when required, make use of such electronic information management system(s) as Owner may employ.

14.7.1 **Procedures.**

14.7.1.1 Procedures for administration of Change Orders shall be established by Owner and stated in the Contract Documents.

14.7.1.2 No oral order, oral statement, or oral direction of Owner or his duly appointed representative shall be treated as a change under this article or entitle Contractor to an adjustment.

14.7.2 **Routine Changes.** Routine changes shall be formally initiated by Design Professional or Owner by means of a Proposal Request form detailing requirements of the proposed change for pricing by Contractor, or may be initiated by Contractor by means of a Change Order Request form detailing proposed work, pricing, and time. This action may be preceded by communications between Contractor, Design Professional, and OCM concerning the need and nature of the change, but such communications shall not constitute a basis for beginning the proposed Work by Contractor. Except for emergency conditions described below, approval of Contractor’s cost proposal by Design Professional and ODR will be required for authorization to proceed with the Work being changed. Owner will not be responsible for the cost of Work changed without prior approval and Contractor may be required to remove Work so installed.

14.7.3 **Documentation.** All proposed costs or time for Change Order Work must be supported by itemized accounting of material, equipment, and associated itemized installation costs in sufficient detail following the outline and organization of the established Schedule of Values, and be supported by documented impact to critical path activities, to permit analysis by Design Professional and ODR using current estimating guides and/or practices. Photocopies of Subcontractor and vendor proposals shall be furnished unless specifically waived by ODR. Contractor shall provide written response to a change request within twenty-one (21) days of receipt.

14.7.4 **Emergencies.** Emergency changes to save life or property may be initiated by Contractor alone with the claimed cost and/or time of such work to be fully documented as to necessity and detail of the reported costs and/or time.

14.7.5 **Coordination with Schedule of Values.** The method of incorporating approved Change Orders into the parameters of the accepted Schedule of Values must be coordinated and administered in a manner acceptable to Owner.

14.8 **Pricing Change Order Work.** The amounts that Contractor and/or its Subcontractor includes in a Change Order for profit and overhead will also be considered by Owner before approval is given. The amounts established hereinafter are the maximums that are acceptable to Owner.
14.8.1 **Self-Performance.** For Work performed by its forces, Contractor will be allowed its actual costs for materials, the total amount of wages paid for labor, plus the total cost of state and federal payroll taxes and of worker’s compensation and comprehensive general liability insurance, plus additional bond and builders risk insurance cost if the change results in an increase in the premium paid by Contractor.

14.8.1.1 To the total of the above costs, Contractor will be allowed to add a percentage to cover overhead and profit combined. Allowable percentages for overhead and profit on changes will not exceed fifteen percent (15%) if the total sum of self-performed Work is less than or equal to $10,000, ten percent (10%) if the total sum of self-performed Work is between $10,000 and $20,000 and five percent (5%) if the total sum of self-performed Work is over $20,000, for any specific change priced.

14.8.2 **Overhead and Profit.** Overhead shall be considered to include insurance beyond the scope of Article 8, field and office supervisors and assistants, including safety and scheduling personnel, use of small tools, incidental job burdens, and general home office expenses. No separate allowance will be made.

14.8.3 **Subcontractor Performed.** For subcontracted Work, each affected Subcontractor shall be allowed to figure costs, overhead, and profit as described in 14.8.1 for Self-Performance.

14.8.4 **Subcontractor Coordination.** Subcontractor costs shall be combined and Contractor will be allowed to add a maximum mark-up of ten percent (10%) if the total sum of all subcontracted Work is less than or equal to $10,000, seven and one-half percent (7.5%) if the total sum of all subcontracted Work is more than $10,000 and less than or equal to $20,000, and five percent (5%) if the total sum of all subcontracted Work is more than $20,000. This markup will apply to subcontractor’s coordination of lesser tier subcontractor Work performed.

14.8.5 **GMP Limitation.** For Contracts based on a GMP, the Construction Manager-at-Risk or Design Builder shall NOT be entitled to a percentage mark-up or additional fee on any Change Order Work unless the Change Order increases the GMP or if contingency funds are utilized. If the GMP increases or contingency funds are utilized, the Construction Manager-at-Risk or Design Builder will be allowed additional fees at the rate specified in the Contract.

14.8.6 **Net Amount.** On changes involving both additions and deletions, percentages for overhead and profit will be allowed only on the net addition. Owner does not accept and will not pay for additional Contract cost identified as indirect or consequential damages or as damages caused by delay.

14.9 **Construction Change Directive (CCD).** Owner may issue a written CCD directing a change in the Work prior to reaching agreement with Contractor on the adjustment, if any, in the Contract Sum and/or the Contract Time. Owner retains sole discretion whether or not to issue any CCD. Owner’s issuance of a CCD does not require Owner to issue subsequent CO’s. Owner and
Contractor shall negotiate for appropriate adjustments, as applicable, to the Contract Sum or the Contract Time arising out of a CCD. Contractor shall not submit its costs for CCD Work with its Application for Payment until a CO has been issued. The Parties reserve their rights as to the disputed amount, subject to Article 18.

14.10 Audit of Changes. All Change Orders are subject to audit by Owner or its representative at any time and Change Order amounts may be adjusted lower as a result of such audit.

ARTICLE 15.
PROJECT COMPLETION AND ACCEPTANCE

15.1 Closing Inspections.

15.1.1 Purpose of Inspection. Inspection is for determining the completion of the Work, and does not relieve Contractor of its overall responsibility for completing the Work in a good and competent fashion, in compliance with the Contract. Work accepted with incomplete Punch list items, or the failure of Owner or other parties to identify Work that does not comply with the Contract Documents or is defective in operation or workmanship, does not constitute a waiver of Owner’s rights under the Contract or relieve Contractor of its responsibility for performance or warranties.

15.1.2 Annotation. Any Certificate issued under this Article may be annotated to indicate that it is not applicable to specified portions of the Work, or that it is subject to any limitation as determined by Owner.

15.1.3 Substantial Completion Inspection. When Contractor considers the entire Work or part thereof Substantially Complete, it shall notify OCM in writing that the Work will be ready for Substantial Completion inspection on a specific date. Contractor shall include with this notice Contractor’s Punch list to indicate that it has previously inspected all the Work associated with the request for inspection, noting items it has corrected and included all remaining work items with date scheduled for completion or correction prior to final inspection. The failure to include any items on this list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If any of the items on this list prevents the Project from being used as intended, Contractor shall not request a Substantial Completion inspection. Owner and its representatives will review the list of items and schedule the requested inspection, or inform Contractor in writing that such an inspection is premature because the Work is not sufficiently advanced or conditions are not as represented on Contractor’s list.

15.1.3.1 Prior to the Substantial Completion inspection, Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties, and like publications or parts for all installed equipment, systems, and like items as described in the
Contract Documents. Delivery of these items is a prerequisite for requesting the Substantial Completion inspection.

15.1.3.2 On the date requested by Contractor, or as mutually agreed upon pending the status of the Open Items List, Design Professional, OCM, Contractor, and other Owner representatives as determined by Owner will jointly attend the Substantial Completion inspection, which shall be conducted by OCM or Owner’s representative. If Owner and Design Professional determines that the Work is Substantially Complete, Design Professional will issue a Certificate of Substantial Completion to be signed by Design Professional, Owner, and Contractor establishing the date of Substantial Completion and identifying responsibilities for security and maintenance. Design Professional will provide with this certificate a list of Punch list items (the pre-final Punch list) for completion prior to final inspection. This list may include items in addition to those on Contractor’s Punch list, which the inspection team deems necessary to correct or complete prior to final inspection. If Owner occupies the Project upon determination of Substantial Completion, Contractor shall complete all corrective Work at the convenience of Owner, without disruption to Owner’s use of the Project for its intended purposes.

15.1.4 Final Inspection. Contractor shall correct or complete all items on the final Punch list before requesting a Final Completion inspection and Final Payment. Unless otherwise agreed to in writing by the parties, Contractor shall complete this work within thirty (30) days of receiving the final Punch list. Upon completion of the final Punch list, Contractor shall notify Design Professional and OCM in writing stating the disposition of each final Punch list item. Design Professional, Owner, and Contractor shall promptly inspect the completed items. When the final Punch list is complete, and the Contract is fully satisfied according to the Contract Documents Design Professional will issue a certificate establishing the date of Final Completion. Completion of all Work is a condition precedent to Contractor’s right to receive Final Payment.

15.1.5 Additional Inspections.

15.1.5.1 If Owner’s inspection team determines that the Work is not Substantially Complete at the Substantial Completion inspection, Owner or Design Professional will give Contractor written notice listing cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to Owner. Contractor shall complete or correct all work so designated prior to requesting a second Substantial Completion inspection. Owner’s or Design Professional’s failure to include items as causes of rejection does not constitute a waiver of Owner’s right under the Contract or relieve Contractor of its responsibility for performance.

15.1.5.2 If Owner’s inspection team determines that the Work is not complete at the Final Completion inspection, Owner or Design Professional will give
Contractor written notice listing the cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to Owner. Contractor shall complete or correct all Work so designated prior to again requesting a final inspection. Owner’s or Design Professional’s failure to include items as causes of rejection does not constitute a waiver of Owner’s right under the Contract or relieve Contractor of its responsibility for performance.

15.1.5.3 The Contract contemplates three (3) comprehensive inspections: the Substantial Completion inspection, the Final Completion inspection, and the inspection of completed final Punch list items. The cost to Owner of additional inspections resulting from the Work not being ready for one or more of these inspections is the responsibility of Contractor. Owner may issue a CO deducting these costs from Final Payment. Upon Contractor’s written request, Owner will furnish documentation of any costs so deducted. Work added to the Contract by Change Order after Substantial Completion inspection is not corrective Work for purposes of determining timely completion, or assessing the cost of additional inspections.

15.1.6 Phased Completion. The Contract may provide, or Project conditions may warrant, as determined by ODR, that designated elements or parts of the Work be completed in phases. Where phased completion is required or specifically agreed to by the parties, the provisions of the Contract related to closing inspections, occupancy, and acceptance apply independently to each designated element or part of the Work. For all other purposes, unless otherwise agreed by the parties in writing, Substantial Completion of the Work as a whole is the date on which the last element or part of the Work completed receives a Substantial Completion certificate. Final Completion of the Work as a whole is the date on which the last element or part of the Work completed receives a Final Completion certificate.

15.2 Owner’s Right of Occupancy. Owner may occupy or use all or any portion of the Work following Substantial Completion, or at any earlier stage of completion. Should Owner wish to use or occupy the Work, or part thereof, prior to Substantial Completion, Owner will notify Contractor in writing and identify responsibilities for security and maintenance. Work performed on the premises by third parties on Owner’s behalf does not constitute occupation or use of the Work by Owner for purposes of this Article. All Work performed by Contractor after occupancy, whether in part or in whole, shall be at the convenience of Owner so as to not disrupt Owner’s use of, or access to, occupied areas of the Project.

15.3 Acceptance and Payment.

15.3.1 Request for Final Payment. Following the certified completion of all Work, including all final Punch list items, cleanup, and the delivery of Record Documents, Contractor shall submit a certified Application for Final Payment and include all sums held as retainage and forward to Design Professional and OCM for review and approval.
15.3.2 **Final Payment Documentation.** Contractor shall submit, prior to or with the Application for Final Payment, final copies of all Close-Out Documents, maintenance and operating instructions, guarantees and warranties, certificates, Record Documents, and all other items required by the Contract. Contractor shall submit evidence of return of access keys and cards, evidence of delivery to Owner of attic stock, spare parts, and other specified materials. Contractor shall submit consent of surety to Final Payment form and an affidavit that all payrolls, bills for materials and equipment, subcontracted work, and other indebtedness connected with the Work, except as specifically noted, are paid, will be paid after payment from Owner, or otherwise satisfied within the period of time required by Tex. Gov’t Code, Chapter 2251. Contractor shall furnish documentation establishing payment or satisfaction of all such obligations, such as receipts, releases, and waivers of claims and liens arising out of the Contract. Contractor may not subsequently submit a claim on behalf of Subcontractor or vendor unless Contractor’s affidavit notes that claim as an exception.

15.3.3 **Design Professional Approval.** Design Professional will review a submitted Application for Final Payment promptly but in no event later than ten (10) days after its receipt. Prior to the expiration of this deadline, Design Professional will either: 1) return the Application for Final Payment to Contractor with corrections for action and resubmission; or 2) accept it, note approval, and send to Owner.

15.3.4 **Offsets and Deductions.** Owner may deduct from the Final Payment all sums due from Contractor. If the Certificate of Final Completion notes any Work remaining, incomplete, or defects not remedied, Owner may deduct the cost of remedying such deficiencies from the Final Payment. On such deductions, Owner will identify each deduction, the amount, and the explanation of the deduction on or by the twenty-first (21st) day after Owner’s receipt of an approved Application for Final Payment. Such offsets and deductions shall be incorporated via a final Change Order, including a CCD as may be applicable.

15.3.5 **Final Payment Due.** Final Payment is due and payable by Owner, subject to all allowable offsets and deductions, on the thirtieth (30th) day following Owner’s approval of the Application for Payment. If Contractor disputes any amount deducted by Owner, Contractor shall give notice of the dispute on or before the thirtieth (30th) day following receipt of Final Payment. Failure to do so will bar any subsequent claim for payment of amounts deducted.

15.3.6 **Effect of Final Payment.** Final Payment shall not constitute a waiver of claims by Owner relating to the condition of the Work including those arising from:

15.3.6.1 Faulty or defective Work appearing after Substantial Completion (latent defects);

15.3.6.2 Failure of the Work to comply with the requirements of the Contract Documents;

15.3.6.3 Terms of any warranties required by the Contract, or implied by law; or
15.3.6.4 Claims arising from personal injury or property damage to third parties.

15.3.7 Waiver of Claims. Acceptance of final payment constitutes a waiver of all claims and liens by Contractor except those specifically identified in writing and submitted to ODR prior to the application for Final Payment.

15.3.8 Effect on Warranty. Regardless of approval and issuance of Final Payment, the Contract is not deemed fully performed by Contractor and closed until the expiration of all warranty periods.

ARTICLE 16.
WARRANTY AND GUARANTEE

16.1 Contractor’s General Warranty and Guarantee. Contractor warrants to Owner that all Work is executed in accordance with the Contract, complete in all parts and in accordance with approved practices and customs, and of the required finish and workmanship. Contractor further warrants that unless otherwise specified, all materials and equipment incorporated in the Work under the Contract are new. Owner may, at its option, agree in writing to waive any failure of the Work to conform to the Contract, and to accept a reduction in the Contract Sum for the cost of repair or diminution in value of the Work by reason of such defect. Absent such a written agreement, Contractor’s obligation to perform and complete the Work in accordance with the Contract Documents is absolute and is not waived by any inspection or observation, or lack thereof, by Owner, Design Professional, or others, by making any progress payment or final payment, by the use or occupancy of the Work or any portion thereof by Owner, at any time, or by any repair or correction of such defect made by Owner.

16.1.1 Warranty Period. Except as may be otherwise specified or agreed, Contractor shall repair all defects in materials, equipment, or workmanship appearing within one (1) year from the date of Substantial Completion of the Work. If Substantial Completion occurs by phase, the warranty period for that particular Work begins on the date of Substantial Completion of that phase, or as otherwise stipulated on the Certificate of Substantial Completion for that particular Work.

16.1.2 Limits on Warranty. Contractor’s warranty and guarantee hereunder excludes defects or damage caused by:

16.1.2.1 Modification or improper maintenance or operation by persons other than Contractor, Subcontractors, or any other individual or entity for whom Contractor is not responsible, unless Owner is compelled to undertake maintenance or operation due to the neglect of Contractor.

16.1.2.2 Normal wear and tear under normal usage after acceptance of the Work by Owner.
16.1.3 **Events Not Affecting Warranty.** Contractor’s obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of defective Work that is not in accordance with the Contract Documents or a release of Contractor’s obligation to perform the Work in accordance with the Contract Documents:

16.1.3.1 Observations, or lack thereof, by Owner and/or Design Professional;
16.1.3.2 Recommendation to pay any progress or final payment by Design Professional;
16.1.3.3 The issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;
16.1.3.4 Use or occupancy of the Project or any part thereof by Owner;
16.1.3.5 Any acceptance by Owner or any failure to do so;
16.1.3.6 Any review by Owner of a Shop Drawing or sample submittal; or
16.1.3.7 Any inspection, test or approval by others.

16.2 **Separate Warranties.** If a particular piece of equipment or component of the Work for which the Contract requires a separate warranty is placed in continuous service before Substantial Completion, the warranty period for that equipment or component will not begin until Substantial Completion, regardless of any warranty agreements in place between suppliers and/or Subcontractors and Contractor. Contractor shall assume any duty to repair not otherwise covered by those warranty agreements. Owner will certify the date of service commencement in the Substantial Completion certificate.

16.2.1 **Assumption.** In addition to Contractor’s warranty and duty to repair, Contractor expressly assumes all warranty obligations required under the Contract for specific building components, systems, and equipment.

16.2.2 **Assignment.** Contractor may satisfy any such obligation by obtaining and assigning to Owner a complying warranty from a manufacturer, supplier, or Subcontractor. Where an assigned warranty is tendered and accepted by Owner which does not fully comply with the requirements of the Contract, Contractor remains liable to Owner on all elements of the required warranty not provided by the assigned warranty.

16.3 **Correction of Defects.** Upon receipt of written notice from Owner, or any agent of Owner designated as responsible for management of the warranty period, of the discovery of a defect, Contractor shall promptly remedy the defect(s), and provide written notice to Owner and designated agent indicating action taken. In case of emergency where delay would cause serious risk of loss or damage to Owner, or if Contractor fails to remedy within thirty (30) days, or within another period agreed to in writing, Owner may correct the defect and be reimbursed the cost of remedying the defect from Contractor or its surety.
16.4 **Certification of No Asbestos Containing Materials or Work.** Contractor shall provide a notarized certification to Owner that all equipment and materials used in fulfillment of its Contract responsibilities are non-Asbestos Containing Building Materials (ACBM). This certification must be provided no later than Contractor’s application for Final Payment. Contractor shall insure that Texas Department of State Health Services licensed individual, consultants or companies are used for any required asbestos work including asbestos inspection, asbestos abatement plans/specifications, asbestos abatement, asbestos project management and third-party asbestos monitoring.

16.5 Contractor shall warrant and ensure compliance with the following Acts by Contractor or Contractor’s Subcontractors and assigns:

- Asbestos Hazard Emergency Response Act (AHERA-40 CFR 763-99 (7));
- National Emission Standards for Hazardous Air Pollutants (NESHAP-EPA 40 CFR 61, Subpart M-National Emission Standard for Asbestos); and
- Texas Asbestos Health Protection Rules (TAHPR-Tex. Admin. Code Title 25, Part 1, Ch. 295C, Asbestos Health Protection)

**ARTICLE 17.**  
**SUSPENSION AND TERMINATION**

17.1 **Suspension of Work for Cause.** Owner may, at any time without prior notice, suspend all or any part of the Work, if after reasonable observation and/or investigation, Owner determines it is necessary to do so to prevent or correct any condition of the Work, which constitutes an immediate safety hazard, or which may reasonably be expected to impair the integrity, usefulness, or longevity of the Work when completed.

17.1.1 **Cease Work.** Owner will give Contractor a written notice of suspension for cause, setting forth the reason for the suspension and identifying the Work suspended. Upon receipt of such notice, Contractor shall immediately stop the Work so identified.

17.1.2 **Investigation.** As soon as practicable following the issuance of such a notice, Owner will initiate and complete a further investigation of the circumstances giving rise to the suspension, and issue a written determination of the findings. Contractor shall cooperate with Owner’s investigation.

17.1.3 **Outcome.** If it is confirmed that the cause was within the control of Contractor, Contractor will not be entitled to an extension of Contract Time or any compensation for delay resulting from the suspension. If the cause is determined not to have been within the control of Contractor, and the suspension has prevented Contractor from completing the Work within the Contract Time, the suspension shall be considered an Excusable Delay and an extension of Contract Time will be granted through a Change Order.
17.1.4 **Time.** Suspension of Work under this provision will be no longer than is reasonably necessary to investigate and remedy the conditions giving rise to the suspension.

17.2 **Suspension of Work for Owner’s Convenience.** Upon seven (7) days written notice to Contractor, Owner may at any time without breach of the Contract suspend all or any portion of the Work for its own convenience. When such a suspension prevents Contractor from completing the Work within the Contract Time, it shall be considered an Excusable Delay. A notice of suspension for convenience may be modified by Owner at any time on seven (7) days written notice to Contractor. If Owner suspends the Work for its convenience for more than sixty (60) consecutive days, Contractor may elect to terminate the Contract pursuant to the provisions of the Contract.

17.3 **Termination by Owner for Cause.**

17.3.1 **Cause.** Upon written notice to Contractor and its surety, Owner may, without prejudice to any right or remedy, terminate the Contract and take possession of the Site and of all materials, equipment, tools, construction equipment, and machinery thereon owned by Contractor under any of the following circumstances:

17.3.1.1 Persistent or repeated failure or refusal, except during complete or partial suspensions of work authorized under the Contract, to supply enough properly skilled workmen or proper materials;

17.3.1.2 Persistent disregard of laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, including Owner;

17.3.1.3 Persistent failure to prosecute the Work in accordance with the Contract, and to ensure its completion within the Contract Time;

17.3.1.4 Failure to remedy defective work;

17.3.1.5 Failure to pay Subcontractors, laborers, and material suppliers pursuant to Tex. Gov’t Code, Chapter 2251;

17.3.1.6 Persistent endangerment to the safety of labor or of the Work;

17.3.1.7 Failure to supply or maintain statutory bonds or to maintain required insurance pursuant to the Contract;

17.3.1.8 Any material breach of the Contract; or

17.3.1.9 Contractor’s insolvency, bankruptcy, or demonstrated financial inability to perform the Work.

17.3.2 **No Waiver.** Failure by Owner to exercise the right to terminate in any instance is not a waiver of the right to do so in any other instance.
17.3.3 **Notice.** Owner may immediately terminate the Contract under the provisions of this Section 17.3 upon written notice to Contractor and Contractor’s sureties. Owner may also give notice to Contractor and Contractor’s sureties of Owner’s intent to terminate the Contract under the provisions of this Section 17.3 at any later date upon written notice to Contractor and its sureties.

17.3.4 **Cure.** Should Contractor or its surety, after having received notice of Owner’s intent to terminate at a later date, demonstrate to the satisfaction of Owner that Contractor or its surety are proceeding to correct such default with diligence and promptness, upon which the notice of intent to terminate was based, the notice of intent to terminate may be rescinded in writing by Owner. If so rescinded, the Work may continue without an extension of Contract Time.

17.3.5 **Failure to Cure.** Should Contractor or its surety fail, after having received notice of Owner’s intent to terminate, to commence and continue correction of such default with diligence and promptness to the satisfaction of Owner within the date specified by Owner, Owner may arrange for completion of the Work and deduct the cost of completion from the unpaid Contract Sum.

17.3.5.1 This amount includes the cost of additional Owner costs such as Design Professional services, other consultants, and contract administration.

17.3.5.2 Owner will make no further payment to Contractor or its surety unless the costs to complete the Work are less than the Contract balance, then the difference shall be paid to Contractor or its surety. If such costs exceed the unpaid balance, Contractor or its surety will pay the difference to Owner.

17.3.5.3 This obligation for payment survives the termination of the Contract.

17.3.5.4 Owner reserves the right in termination for cause to take assignment of all the Contracts between Contractor and its Subcontractors, vendors, and suppliers. Owner will promptly notify Contractor of the contracts Owner elects to assume. Upon receipt of such notice, Contractor shall promptly take all steps necessary to effect such assignment.

17.3.6 **Conversion to Termination for Convenience.** In the event that any termination of the Contract for cause under this Section 17.3 is later determined to have been improper, the termination shall automatically convert to a termination for convenience of Owner and Contractor’s recovery for termination shall be strictly limited to the payments allowable under Subsection 17.4.3.

17.4 **Termination for Convenience of Owner.** Owner reserves the right, without breach, to terminate the Contract prior to, or during the performance of the Work, for any reason. Upon such an occurrence, the following shall apply:
17.4.1 **Notice.** Owner will immediately notify Contractor and Design Professional in writing, specifying the reason for and the effective date of the Contract termination. Such notice may also contain instructions necessary for the protection, storage, or decommissioning of incomplete Work or systems, and for safety.

17.4.2 **Contractor Action.** Upon receipt of the notice of termination, Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due at that point in the Contract:

17.4.2.1 Stop all work.

17.4.2.2 Place no further subcontracts or orders for materials or services.

17.4.2.3 Terminate all subcontracts for convenience.

17.4.2.4 Cancel all materials and equipment orders as applicable.

17.4.2.5 Take action that is necessary to protect and preserve all property related to the Contract which is in the possession of Contractor.

17.4.3 **Contractor Remedy.** When the Contract is terminated for Owner’s convenience, Contractor may recover from Owner payment for all Work completed including the corresponding pro rata portion of Contractor’s overhead and profit. Contractor may not claim lost profits on other work or lost business opportunities.

17.5 **Termination by Contractor.** If the Work is stopped for a period of ninety (90) days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of Contractor or Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with Contractor, then Contractor may, upon thirty (30) additional days written notice to ODR, terminate the Contract and recover from Owner payment for all Work completed including the corresponding pro rata portion of Contractor’s overhead and profit, but not lost profits on other work or lost business opportunities. If the cause of the Work stoppage is removed prior to the end of the thirty (30) day notice period, Contractor may not terminate the Contract.

17.6 **Settlement on Termination.** When the Contract is terminated for any reason, at any time prior to one hundred eighty (180) days after the effective date of termination, Contractor shall submit a final termination settlement proposal to Owner based upon recoverable costs as provided under the Contract. If Contractor fails to submit the proposal within the time allowed, Owner may determine the amount due to Contractor because of the termination and pay the determined amount to Contractor as final payment.
ARTICLE 18.
DISPUTE RESOLUTION

18.1 Contracts Less Than $250,000. The dispute resolution process provided for in Texas Government Code, Chapter 2260, shall be used by Contractor or Design Professional to attempt to resolve any claim for breach of Contract made by Contractor or Design Professional that is not resolved under procedures described throughout the Uniform General Conditions or any Supplementary or Special Conditions of the Contract, where the amount in controversy is less than $250,000.

18.2 Contracts $250,000 or Greater. Contractor or Design Professional and Owner shall use the following dispute resolution process prior to initiating any litigation or filing suit in a court of competent jurisdiction.

18.2.1 Mediation. If a dispute arises out of or relates to the Contract or the breach thereof in which the amount in controversy is $250,000 or greater, and if the dispute cannot be settled through negotiation, the parties agree first to try to settle the dispute by mediation using the procedures specified in this section prior to the commencement of any legal action. The parties commit to participate in the proceedings in good faith with the intention of resolving the dispute if at all possible.

18.2.1.1 The party seeking to initiate mediation of a dispute shall give written notice to the other party describing the nature of the dispute, the initiating party’s claim for relief and identifying one or more individuals with authority to settle the dispute on such party’s behalf. The party receiving such notice shall have five (5) business days to designate by written notice one or more individuals with authority to settle the dispute on such party’s behalf.

18.2.1.2 The parties shall then have ten (10) business days to submit to each other a written list of acceptable qualified mediators not affiliated with any of the parties. The mediator shall possess the qualifications required under Civil Practice and Remedies Code, § 154.052, be subject to the standards and duties prescribed by Civil Practice and Remedies Code, §154.053, and have the qualified immunity prescribed by Civil Practice and Remedies Code, §154.055, if applicable. The parties shall mutually agree on the mediator.

18.2.1.3 In consultation with the mediator selected, the parties shall promptly designate a mutually convenient time and place for the mediation, and unless circumstances require otherwise, such time to be not later than forty-five (45) days after selection of the mediator.

18.2.1.4 The parties agree to participate in the mediation to its conclusion. The mediation shall be terminated (i) by the execution of a settlement agreement by the parties, (ii) by a declaration of the mediator that the mediation is terminated, or (iii) by a written declaration of a party to the effect that the mediation process is terminated at the conclusion of one (1) full day's mediation session. Even if the mediation is terminated without a resolution of
the dispute, the parties agree not to terminate negotiations and not to commence any legal action or seek other remedies prior to the expiration of five (5) days following the mediation. Notwithstanding the foregoing, any party may commence litigation within such five (5) day period if litigation could be barred by an applicable statute of limitations or in order to request an injunction to prevent irreparable harm.

18.2.1.5 The parties shall share the cost of the mediation process equally although each party’s attorneys and witnesses or specialists are the direct responsibility of each party and their fees and expenses shall be the responsibility of the individual parties.

18.2.1.6 The entire mediation process is confidential, and no stenographic, visual or audio record shall be made. All conduct, statements, promises, offers, views and opinions, whether oral or written, made in the course of the mediation by any party, their agents, employees, representatives or other invitees and by the mediator are confidential and shall, in addition and where appropriate, be deemed to be privileged and shall not be discoverable or admissible for any purpose, including impeachment, in any litigation or other proceeding involving the parties.

18.3 **Owner Retained Rights.** Nothing herein shall hinder, prevent, or be construed as a waiver of Owner’s right to seek redress on any disputed matter in a court of competent jurisdiction.

18.4 **No Waiver.** Except as may be expressly and specifically provided otherwise by Chapter 114, Texas Civil Practice & Remedies Code, nothing herein shall be construed as a waiver of sovereign immunity; nor constitute or be construed as a waiver of any of the privileges, rights, defenses, remedies, or immunities available to the State of Texas or the University of North Texas System.

18.5 **No Attorney’s Fees.** In any litigation between Owner and Contractor or Design Professional arising from the Contract or Project, neither party will be entitled to an award of legal fees or costs in any judgment regardless of which is deemed the prevailing party.

18.6 **Interest.** Pre-judgment and post-judgment interest shall be limited to the rate of one and a half percent (1.5%) per annum.

**ARTICLE 19. MISCELLANEOUS**

19.1 **Right to Audit.** Owner, or any of its duly authorized auditors or representatives including the State Auditor’s Office, shall during regular business hours and upon reasonable notice have access to and the right to examine, and be permitted to audit and copy, any directly pertinent books, documents, papers, and records of Contractor, including, without limitation, complete documentation supporting accounting entries, books, correspondence, instructions, drawings, receipts, subcontracts, Subcontractor’s quotes, proposals, purchase order, vouchers, memoranda,
schedules, electronic data, pictures, videos, logs, minutes, notes, reports and other data relating to the Project. Further, Contractor or Design Professional agree to include in all subcontracts a provision to the effect that Subcontractor agrees that Owner or any of its duly authorized representatives shall have access to and the right to examine any directly pertinent books, documents, papers, and records of such Subcontractor relating to any claim arising from the Contract and subcontract, whether or not the Subcontractor is a party to the claim. The period of access and examination described herein shall continue until the later of five (5) years after Final Payment or final disposition of any disputes, claims, litigation, or appeals arising out of the Contract.

19.2 **Supplementary or Special Conditions.** When the Work contemplated by Owner is of such a character that the foregoing Uniform General Conditions of the Contract cannot adequately cover necessary and additional contractual relationships, the Contract may include Supplementary General or Special Conditions as described below:

19.2.1 **Supplementary Conditions.** Supplementary Conditions may describe the standard procedures and requirements of contract administration. Supplementary Conditions may expand upon matters covered by the Uniform General Conditions, where necessary, provided the expansion does not weaken the character or intent of the Uniform General Conditions. Supplementary Conditions are of such a character that it is to be anticipated that Owner may normally use the same, or similar, conditions to supplement each of its several projects.

19.2.2 **Special Conditions.** Special Conditions shall relate to a particular Project and be unique to that Project but shall not weaken the character or intent of the Uniform General Conditions.

19.3 **Federally Funded Projects.** On federally funded projects, Owner may waive, suspend, or modify any provision in these Uniform General Conditions which conflicts with any federal statute, rule, regulation, or procedure, where such waiver, suspension, or modification is essential to receipt by Owner of such federal funds for the Project. In the case of any Project wholly financed by federal funds, any standards required by the enabling federal statute, or any federal rules, regulations, or procedures adopted pursuant thereto, shall be controlling.

19.4 **Internet-based Project Management Systems.** At its option, Owner may administer its design and construction management through an Internet-based management system. In such cases, Contractor shall conduct communication through this media and perform all Project related functions utilizing this database system. This includes correspondence, submittals, Requests for Information, vouchers, or payment requests and processing, amendment, Change Orders, and other administrative activities.

19.4.1 **Accessibility and Administration.**

19.4.1.1 When used, Owner will make the software accessible via the Internet to all Project team members.

19.4.1.2 Owner shall administer the software.
19.4.2 Training. When used, Owner shall provide training to the Project team members.

19.5 Computation of Time. In computing any time period set forth in this Contract, the first day of the period shall not be included, but the last day shall be.

19.6 Survival of Obligations. All representations, indemnifications, warranties and guarantees made in accordance with the Contract Documents will survive final payment, completion and acceptance of the Work, as well as termination for any reason. All duties imposed upon the Contractor by reason of termination, including without limitation the duty to assign subcontracts and contracts with vendors and suppliers, shall likewise survive the termination of the Contract.

19.7 No Waiver of Performance. The failure of either party in any instance to insist on the performance of any of the terms, covenants or conditions of the Contract Documents, or to exercise any of the rights granted thereunder, shall not be construed as waiver of any such term, covenant, condition or right with respect to further performance.

19.8 Governing Law and Venue. This Contract shall be governed by the laws of the State of Texas. Venue for any suit arising from the Contract will be in a court of competent jurisdiction subject to the mandatory venue statute set forth in § 105.151 of the Texas Education Code, or if mandatory venue is not applicable in the county in which the Project is located.

19.9 Captions and Catch Lines. The captions and catch lines used throughout the Uniform General Conditions and elsewhere in the Contract Documents are for ease of reference only and have no effect on the meaning of the terms and conditions set forth herein.

19.10 Independent Contractor Status. The Contract Documents create an independent contractor relationship between the Owner and Contractor and neither party’s employees or contractors shall be considered employees, contractors, partners or agents of the other party.

19.11 No Third-Party Beneficiaries. The parties do not intend, nor shall any clause be interpreted to create in any third party, any obligations to, or right of benefit by, such third party under these Contract Documents from either the Owner or Contractor.

19.12 Child Support Obligor. Notwithstanding anything to the contrary within the Contract Documents, it is understood and agreed between the parties that in accordance with the laws of the State of Texas, a child support obligor who is more than thirty (30) days delinquent in paying child support, and a business entity in which an obligor is a sole proprietor, partner, shareholder, or owner with an ownership interest of at least twenty-five percent (25%), is not eligible to receive payments from state funds under a contract to provide property, materials or services until all arrearages have been paid or the obligor is in compliance with a written repayment agreement.

19.13 Buy America Requirements for Iron and Steel Used in Construction. In accordance with Texas Government Code 2252, Section 2252.202, all iron or steel products (i.e., rolled structural shapes including wide flange beams and columns, angles, bars, plates, sheets, hollow structural sections, pipe, etc.) shall be produced, manufactured and fabricated in the United States.
19.14 No Assignment. This Contract may not be assigned by either party without the prior written consent of the other, except either party may, upon notice to the other party but without the other party’s consent, assign this Contract to a present or future affiliate or successor, provided that any such assignment by Contractor shall be contingent on Owner’s determination that the assignee is qualified to perform the Work, is in good standing with the State of Texas and otherwise eligible to do business with the State of Texas.

19.15 Severability. If any provision, sentence, clause or article of this Contract is found to be invalid or unenforceable for any reason, the remaining provisions shall continue in effect as if the invalid or unenforceable provision were not in the Contract. All provisions, sentences, clauses and articles of this Contract are severable for this purpose.

19.16 Parties Bound. Execution of this Contract by each party binds the entity represented as well as its employees, agents, successors and assigns to its faithful performance.

19.17 Public Information. Owner shall release information to the extent required by the Texas Public Information Act and other applicable law. If requested, Contractor shall make public information available to Owner in an electronic format.

19.18 Entire Agreement. These Contract Documents supersede in full all prior discussions and agreements (oral and written) between the parties relating to the subject matter hereof and constitute the entire agreement.
SECTION 011000

SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes:
   1. Project information
   2. Work covered by Contract Documents
   3. Phased construction
   4. Work by Owner
   5. Owner-furnished products
   6. Access to site
   7. Coordination with occupants
   8. Work restrictions
   9. Specification and drawing conventions
   10. Special provisions
   11. Purpose of Division 1 – General Requirements

1.3 PROJECT INFORMATION
A. Owner: University of North Texas System
B. Project Identification: UNT – Retail – Interior Build Out, #2016233-003
C. Project Location: 1416 Maple Street, Denton, Texas 76201
   1. Owner's Construction Manager – Jeannine Vail
D. Architect: Kirksey | Architecture
E. Project Web Site: A Project Web site administered by the Contractor will be used for purposes of managing communication and documents during the construction stage.
   1. See Division 01 Section 013100 "Project Management and Coordination" for Contractor's requirements for utilizing the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS
A. The Work of the Project is defined by the Contract Documents and consists of the following:
   1. Build out of the retail space at the newly built dining hall, Eagle Landing. The retail space is approximately 2,700 GSF. It is consistent with the institution's strategic plan and campus master plan. The facility includes market area, coffee/bakery servery and Which wich servery along with associated kitchen, preparation, storage, wash room, and other necessary support areas for a modern retail facility. The retail space is to provide the students and faculty a unique experience of a coffee shop and market, by the use of its materials, rich warm wood porcelain tile tones, and patina metal porcelain tile tones, in an intimate setting with lots of natural light.
B. Type of Contract
   1. Project will be constructed under a Competitive Sealed Proposal contract.

1.5 WORK BY OWNER
A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
B. Fees Paid by Owner: Impact Fees.
C. Fees Reimbursed by Owner: Tap Fees and Meter Fees.

1.6 ACCESS TO SITE
A. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated. Use of any area outside of work area must be approved by Owner.
B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather-tight condition throughout construction period. Repair damage caused by construction
operations to equal or better condition.

1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner’s day-to-day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
   2. Notify the Owner not less than three (3) days in advance of activities that will affect Owner’s operations.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner’s operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than three (3) day notice to Owner of activities that will affect Owner’s operations.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, except as otherwise indicated.
   1. Hours for Utility Shutdowns: Coordinated with Owner, with not less than two (2) weeks written notice of intended shutdown.
   2. Hours for core drilling and other noisy activities: To be coordinated with UNT System Construction Manager.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than three (3) days in advance of proposed utility interruptions.
   2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than three (3) days in advance of proposed disruptive operations.
   2. Obtain Owner’s written permission before proceeding with disruptive operations.

E. Nonsmoking Campus: Smoking is not permitted anywhere on any UNT campus.

F. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words “shall,” “shall be,” or “shall comply with,” depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification...
Section numbers found in this Project Manual.

1.10 SPECIAL PROVISIONS
Review Owner’s Campus Design Guidelines (Denton ONLY) available at https://facilities.unt.edu/sites/default/files/DESIGN%20GUIDELINES%202017_rev%203_09.01.17.pdf

1.11 DIVISION 1 – GENERAL REQUIREMENTS
A. The specification sections contained with Division 01 – General Requirements, serve to expand and define in more detail, the administrative and procedural requirements outlined in Section 007000 – General Conditions. Should any provisions with Division 01 sections be in conflict with the General Conditions, the General Conditions shall govern.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS
A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES
A. Unit prices include all necessary material, cost for delivery, installation, insurance, overhead, and profit.
B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES
A. Unit Price No. - Insert unit price item :
1. Description: Insert unit-price item description according to Division Section , "Title ".
2. Unit of Measurement:
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section 012100, "Allowances".

END OF SECTION
SECTION 012300
ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS
A. Alternate: An amount proposed by Contractor and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES
A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
C. Execute accepted alternates under the same conditions as other work of the Contract.
D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES
A. Alternate No. : Insert Title .
1. Base Bid: Insert brief description of base bid requirement as indicated on Sheet Title and as specified in Division Section , " Title ".
2. Alternate: Insert brief description of alternate requirement as indicated on Sheet Title and as specified in Division Section , " Title ".

END OF SECTION
SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS
A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS
A. Substitution Requests: Submit one (1) PDF file of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use CSI Form 012500.13
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product, fabrication, or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data: including drawings and descriptions of products and fabrication and installation procedures
      e. Samples, where applicable or requested
      f. Certificates and qualification data, where applicable or requested
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
      j. Detailed comparison of Contractor’s construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
      k. Cost information, including a proposal of change, if any, in the Contract Sum.
      l. Contractor’s certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
      m. Contractor’s waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   3. Design Professional’s Action: If necessary, Design Professional will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Design Professional will notify Contractor of acceptance or rejection of proposed substitution within fifteen days of receipt of information or documentation.
(15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
  a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect’s Supplemental Instructions for minor changes in the Work.
  b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE
   A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES
   A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS
   A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
   1. Conditions: Design Professional will consider Contractor’s request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor’s construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
   B. Substitutions for Convenience: Not allowed, unless otherwise indicated. If allowed Design Professional will consider requests for substitution if received within sixty (60) days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Design Professional.
   1. Conditions: Design Professional will consider Contractor’s request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner’s additional responsibilities may include compensation to Architect Design Professional redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor’s construction schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.
      g. Requested substitution is compatible with other portions of the Work.
      h. Requested substitution has been coordinated with other portions of the Work.
      i. Requested substitution provides specified warranty.
      j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
SECTION 012500.13
SUBSTITUTION REQUEST FORM

PROJECT: _______________________________ (After Contract Award)

TO: ___________________________________
_____________________________________

NO. ___________ DATE: _______________

Contractor hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section 012500 “Substitution Procedures”:

1. SPECIFIED PRODUCT OR SYSTEM

   Substitution request for: _______________________________________________________

   Specification Section No.: _______________ Article/ Paragraph: ___________________

2. REASON FOR SUBSTITUTION REQUEST

   SPECIFIED PRODUCT                  PROPOSED PRODUCT
   ☐ Is no longer available        ☐ Will reduce construction time
   ☐ Is unable to meet project schedule ☐ Will result in cost savings of
   ☐ Is unsuitable for the designated application $ _____________ to Project
   ☐ Cannot interface with adjacent materials ☐ Is for supplier’s convenience
   ☐ Is not compatible with adjacent materials ☐ Is for subcontractor’s convenience
   ☐ Cannot provide the specified warranty ☐ Other: ___________________________
   ☐ Cannot be constructed as indicated _______________________________________
   ☐ Cannot be obtained due to one or more of the following:
     ☐ Strike        ☐ Bankruptcy of manufacturer or supplier
     ☐ Lockout       ☐ Similar occurrence (explain below)

3. SUPPORTING DATA

   ☐ Drawings, specifications, product data, performance data, test data, and any other necessary information to facilitate review of the Substitution Request are attached.

   ☐ Sample is attached          ☐ Sample will be sent if requested

4. QUALITY COMPARISON

   Provide all necessary side-by-side comparative data as required to facilitate review of Substitution Request:

<table>
<thead>
<tr>
<th>SPECIFIED PRODUCT</th>
<th>PROPOSED PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer:</td>
<td>____________________</td>
</tr>
<tr>
<td>Name / Brand:</td>
<td>____________________</td>
</tr>
<tr>
<td>Catalog No.:</td>
<td>____________________</td>
</tr>
</tbody>
</table>
Vendor:  ____________________________________________

Variations:  ____________________________________________

(Add Additional Sheets If Necessary)

Local Distributor or Supplier:  ____________________________________________

Maintenance Service Available:  ☐ Yes  ☐ No

Spare Parts Source:  ____________________________________________

Warranty:  ☐ Yes  ☐ No  ____ Years

5.  PREVIOUS INSTALLATIONS

Identification of at least three (3) similar projects on which proposed substitution was used:

PROJECT #1
Project:  ____________________________________________
Address:  ____________________________________________
Architect:  ____________________________________________
Owner:  ____________________________________________
Contractor:  ____________________________________________
Date Installed:  ____________________________________________

PROJECT #2
Project:  ____________________________________________
Address:  ____________________________________________
Architect:  ____________________________________________
Owner:  ____________________________________________
Contractor:  ____________________________________________
Date Installed:  ____________________________________________

PROJECT #3
Project:  ____________________________________________
Address:  ____________________________________________
Architect:  ____________________________________________
Owner:  ____________________________________________
Contractor:  ____________________________________________
Date Installed: ____________________________________________________________

6. **EFFECT OF SUBSTITUTION**

   Proposed substitution affects other work or trades:  
   - [ ] No  
   - [ ] Yes (if yes, explain)

   Proposed substitution requires dimensional revisions or redesign of architectural, structural, M-E-P, life safety, or other work:
   - [ ] No  
   - [ ] Yes (if yes, attach data explaining revisions)

7. **STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS**

   Contractor and Subcontractor have investigated the proposed substitution and hereby represent that:
   
   A. They have personally investigated the proposed substitution and believe that it is equal to or superior in all respects to specified product, except as stated above;
   
   B. The proposed substitution is in compliance with applicable codes and ordinances;
   
   C. The proposed substitution will provide same warranty as specified for specified product;
   
   D. They will coordinate the incorporation of the proposed substitution into the Work, and will include modifications to the Work as required to fully integrate the substitution;
   
   E. They have included complete cost data and implications of the substitution (attached);
   
   F. They will pay any redesign fees incurred by the Architect or any of the Design Professional’s consultants, and any special inspection costs incurred by the Owner, caused by the use of this product;
   
   G. They waive all future claims for added cost or time to the Contract related to the substitution, or that become known after substitution is accepted.
   
   H. The Design Professional's approval, if granted, will be based upon reliance upon data submitted and the opinion, knowledge, information, and belief of the Design Professional at the time decision is rendered and Addendum is issued; and that Design Professional’s approval therefore is interim in nature and subject to reevaluation and reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed.

   Contractor: ________________________________________________________________
   
   (Name of Contractor)
   
   Date: ___________________ By: ________________________________________________
   
   Subcontractor: ____________________________________________________________
   
   (Name of Subcontractor)
   
   Date: ___________________ By: ________________________________________________

   **Note:** Unresponsive or incomplete requests will be rejected and returned without review.

8. **DESIGN PROFESSIONAL’S REVIEW AND ACTION**

   - [ ] Substitution is accepted.
   
   - [ ] Substitution is accepted, with the following comments: _______________________
   
   - [ ] Resubmit Substitution Request:

   KIRKSEY
☐ Provide more information in the following areas: ______________________
_______________________________________________________________
__________________
_____________________________________________

☐ Provide proposal indicating amount of savings / credit to Owner
☐ Bidding Contractor shall sign Bidder's Statement of Conformance
☐ Bidding Subcontractor shall sign Bidder's Statement of Conformance

☐ Substitution is not accepted:
  ☐ Substitution Request received too late.
  ☐ Substitution Request received directly from subcontractor or supplier.
  ☐ Substitution Request not submitted in accordance with requirements.
  ☐ Substitution Request Form is not properly executed.
  ☐ Substitution Request does not indicate what item is being proposed.
  ☐ Insufficient information submitted to facilitate proper evaluation.
  ☐ Proposed product does not appear to comply with specified requirements.
  ☐ Proposed product will require substantial revisions to Contract Documents.

By: ____________________________
Date: _________________________

Design Professional has relied upon the information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall provide the specified product.

9. OWNER'S REVIEW AND ACTION
  ☐ Substitution is accepted for items not involving additional costs.
  ☐ Substitution is not accepted.

By: ____________________________
(Owner's Construction Manager)

Date: _________________________

END OF FORM
SECTION 012600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
B. Related Sections:
   1. Division 01 Section 016000, "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK
A. Design Professional will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions." or Architect’s Bulletin form.

1.4 CHANGE ORDER REQUESTS
A. Owner/Design Professional-Initiated Change Order Requests: will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Change Order Requests issued by Owner/Design Professional are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Change Order Request after receipt of Change Order Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor’s construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.
      e. Quotation Form: Use Change Order Request (COR) form. Contractor shall complete the COR Cost Analysis form and the Sub-Contractor shall submit the Sub-Contractor Cost Analysis form with supporting documentation and cost breakdown by line item, or other form approved by Owner.

B. Contractor-Initiated Change Orders: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Owner/Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor’s construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Division 01 Section 012500, "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   7. Change Order Request Form: Use Owner’s standard Change Order Request form as approved by Owner and Design Professional.
1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: Refer to Division 01, Section 012100, “Allowances” for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit Price Adjustment: Refer to Division 01 Section 012200, “Unit Prices” for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner’s approval of a Change Order Request, Owner will prepare and issue a Change Order on attached form for signatures of Owner, Design Professional and Contractor.

1.7 CONSTRUCTION CHANGE DIRECTIVE

   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)  END OF SECTION
CONSTRUCTION CHANGE ORDER

☐ Construction Agreement
☐ JOC Job Order

JO Date: __________________________

FROM OWNER:
University of North Texas System
1155 Union Circle #311040
Denton, TX 76203

TO CONTRACTOR: (Name and Address)

CHANGE ORDER NO.: __________________________
DATE: __________________________
CIP PROJECT NO.: __________________________
PO NO.: __________________________

A/E NAME: __________________________

PROJECT/CONTRACT NO.: __________________________
CONTRACT DATE: __________________________
PROJECT NAME: __________________________

The Agreement is changed as follows:

All Services provided per _______ attached are hereby incorporated by reference for all purposes.

The original Agreement, Early Release Packages, and/or GMP Amendment Sum:

The net change by previously authorized Change Orders:

The Agreement Sum prior to this Change Order:

The Agreement Sum will be increased by this Change Order in the amount of

New Agreement Sum including this Change Order:

The TIME of the project has increased by _______ days

The date of SUBSTANTIAL COMPLETION as of the date of this Change Order is __________________________

Or if services are being provided after SUBSTANTIAL COMPLETION

The completion date of the services provided in this Change Order will be __________________________

NOT VALID UNTIL SIGNED BY THE A/E, CONTRACTOR AND OWNER

A/E (Firm Name) __________________________
By (Signature) __________________________
Name (Typed or Printed Name) __________________________
Title __________________________
Date __________________________

CONTRACTOR (Firm Name) __________________________
By (Signature) __________________________
Name (Typed or Printed Name) __________________________
Title __________________________
Date __________________________

OWNER __________________________
By (Signature) __________________________
Name (Typed or Printed Name) __________________________
Title __________________________
Date __________________________

Approved by UNTS OGC through 12/31/2021
The following change in the Contract Documents is approved by the Owner and the Work is authorized to proceed accordingly:

Additional Days Required  Calendar Days Not to Exceed Cost $ -

When the Owner and Contractor agree upon the exact adjustment in the Contract Price and/or the Contract Time for a change in the Work directed by this Construction Change Directive, such agreement shall be the subject of a Change Order.

The Change Order shall include all outstanding Construction Change Directives that the contractor would like to include on an application for payment.

A Change Order must be executed before the Contractor is allowed to add the Work described above on an application for payment.

Owner
University of North Texas (System or Institution Name)

Authorized Signatory Name
Authorized Signatory Title
Date
SECTION 012900
PAYMENT PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 01 Specifications Sections apply to this Section.

1.2 SUMMARY
A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
B. Related Sections include the following:
   1. Division 01 Section 012600 for administrative procedures for handling changes to the Contract.
   2. Division 01 Section 013200 for administrative requirements governing preparation and submittal of Contractor’s Construction Schedule and Submittal Schedule.
   3. Division 00 Section 007000 – University of North Texas System Uniform General Conditions and Supplementary General Conditions 2019, Amended.

1.3 DEFINITIONS
A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor’s Application for Payment. The Schedule of Values is a form provided by Owner to Contractor.

1.4 SCHEDULE OF VALUES
A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor’s Construction Schedule
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules including the following:
      a. Application for Payment form with Continuation Sheets
      b. Submittal Schedule
      c. Contractor’s Construction Schedule
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven calendar days before the date scheduled for submittal of initial Application for Payment.
   3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules indicating values correlated with each phase of payment.
B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location
      b. Name of Architect
      c. Architect’s project number
      d. Contractor’s name and address
      e. Date of submittal
   2. The Schedule of Values is formatted using CSI Divisions. (see form instructions)
   3. Draft Submittals: Submit in same format as final payment application
   4. Arrange the Schedule of Values in tabular form with separate sections to indicate the following for each item listed:
      a. Related Specification Section or Division
      b. Change Orders (numbers) that affect value
      c. Dollar value
1) Percentage of the Contract Sum to nearest one-tenth percent adjusted to total 100 percent.

5. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Owner/Architect will review Contractor’s Schedule of Values and approve upon receipt of sufficient detail as deemed satisfactory to Owner/Architect.

6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance and storage in bonded warehousing for materials stored off-site.
   b. For major items provide separate line items for materials and labor based on CSI Master Format Division. Major items include but not limited to:

   • Division 01 - General Requirements
   • Division 02 - Existing Conditions
   • Division 03 - Concrete
   • Division 04 - Masonry
   • Division 05 - Metals
   • Division 06 - Wood, Plastics, Composites
   • Division 07 - Thermal and Moisture Protection
   • Division 08 - Openings
   • Division 09 - Finishes
   • Division 10 - Specialties
   • Division 11 - Equipment
   • Division 12 - Furnishings
   • Division 13 - Special Construction
   • Division 14 - Conveying Equipment
   • Division 21 - Fire Suppression
   • Division 22 - Plumbing
   • Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)
   • Division 25 - Integrated Automation
   • Division 26 - Electrical
   • Division 27 - Communications
   • Division 28 - Electronic Safety and Security
   • Division 31 - Earthwork
   • Division 32 - Exterior Improvements
   • Division 33 - Utilities
   • Division 34 - Transportation
   • Division 35 - Waterway and Marine Construction
   • Division 40 - Process Integration
   • Division 41 - Material Processing and Handling Equipment
   • Division 42 - Process Heating, Cooling, and Drying Equipment
   • Division 43 - Process Gas and Liquid Handling, Purification and Storage Equipment
   • Division 44 - Pollution and Waste Control Equipment
   • Division 45 - Industry-Specific Manufacturing Equipment
   • Division 46 - Water and Wastewater Equipment
   • Division 48 - Electrical Power Generation
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost.

8. In addition to line item costs of Sections in Division 02 thru 39, furnish line item costs for each item of the following general administrative and procedural cost items.
   a. Bonds
   b. Insurance
   c. Mobilization
   d. Field Superintendence
   e. Temporary Facilities
   f. Trench Safety
   g. Clean-up and Disposal
   h. Project Close Out
   i. Final Cleaning
   j. Demobilization
   k. Overhead and General Conditions
   l. Contractor’s Fee

9. Plumbing, HVAC, Electrical and Life Safety work shall be broken down in accordance with the following subcategories as a minimum:
   a. Fire Protection:
   b. Plumbing:
   c. Heating, Ventilating and Air Conditioning (HVAC):
   d. Electrical:
   e. Fire Detection and Alarm:

10. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Electronically deliver in a format approved by Owner after the Design Professional has certified the Payment Application Payment processing will start as soon as we receive and date stamp the payment. In return the Contractor will be given a receipt that will be initialed and a photocopy will be provided to the Contractor.

B. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion and Final Application for Payment involve additional requirements.

C. Payment Application Times: Progress payment is due once a month.

D. Payment Application Forms: Use Application for Payment form to be furnished by Owner.

E. Application Preparation: Complete every entry on form. Application to be Notarized by a Notary and executed by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor’s Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Order issued before the last day of construction period covered by application.
   3. Include supporting documentation including subcontractor and supplier invoices.

F. Transmittal: Prepare one copy with original signatures and original notary of each Application for Payment by a method ensuring receipt within 24-hours. The copy shall include waivers of lien, schedule updates, contractor’s executive summary and similar attachments.
   1. Transmit each package with a transmittal form listing attachments and recording appropriate information about application including subcontractor supplemental documentation and required general conditions documents.
G. Waivers of Mechanic’s Lien: With each Application for Payment, submit waivers of mechanic’s lien from subcontractors, sub-subcontractors and suppliers for construction period covered by the previous application.
   1. Submit partial lien waivers on each item for amount requested in previous applications after deduction for retainage of each item.
   2. When an application shows completion of an item, submit final or full lien waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit lien waivers.
   4. Submit final Application for Payment with, or proceeded by, final lien waivers from every entity involved with performance of the Work covered by the application that is lawfully entitled to a lien.
   5. Waiver Forms: Submit waivers of lien on forms executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment.
   1. Include the following:
      a. List of subcontractors
      b. Schedule of Values
      c. Contractor’s Construction Schedule (preliminary if not final)
      d. Products list
      e. Submittal Schedule (preliminary if not final)
      f. List of Contractor’s staff assignments
      g. List of Contractor’s principal consultants
      h. Initial progress report
      i. Report of preconstruction conference
      j. Certificates of insurance and insurance policies
      k. Performance and payment bonds
      l. Data needed to acquire Owner’s insurance

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit Final Application for Payment within thirty (30) days of Substantial Completion along with releases and supporting documentation not previously submitted and accepted including, but not limited to, the following:
   1. Evidence of completion of Project closeout requirements
   2. Insurance certificate for products and completed operations where required and proof taxes, fees and similar obligations were paid
   3. Updated final statement accounting for final changes to the Contract Sum
   4. AIA Document G706, “Contractor’s Affidavit of Payment of Debts and Claims”
   5. AIA Document G706A, “Contractor’s Affidavit of Release of Liens”
   6. AIA Document G707, “Consent of Surety to Final Payment”
   7. Evidence that claims have been settled

K. Electronic Fund Transfer (EFT): Vendors are encouraged to utilize EFT for the distribution of all future payments. To sign up for EFT, complete the EFT Agreement (Supplier) at, https://www.untsystem.edu/sites/default/files/forms/procurement/supplier_eft_form_revised.pdf. Once established, all future payments will be made by EFT. When an EFT payment is made, an email will be sent to the email address you specify on the EFT agreement form. If you have any questions, please contact the Business Service Center at bsc@untsystem.edu or 940-369-5500.
PART 2 – PRODUCTS  (Not Used)
PART 3 – EXECUTION  (Not Used)

END OF SECTION
SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
      1. General project coordination procedures
      2. Administrative and supervisory personnel
      3. Coordination drawings
      4. Requests for Information (RFIs)
      5. Project Web site
      6. Project meetings
   B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.3 DEFINITIONS
   A. RFI: Request from Contractor seeking information from each other during construction.

1.4 COORDINATION
   A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1.5 COORDINATION DRAWINGS
   A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

       a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare
sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Design Professional indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines, including fire protection requirements.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment
   c. Fire-rated enclosures around ductwork

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1½-inch diameter and larger
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations
   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor control center locations
   d. Location of pull boxes and junction boxes, dimensioned from column center lines

8. Fire Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Design Professional will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor’s responsibility. If the Design Professional determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Design Professional will so inform the Contractor (copy the Owner), who shall make changes as directed and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section 013300, "Submittal Procedures".

C. Coordination Digital Data Files: Prepare coordination digital data files in accordance with the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as the original Drawings.

2. File Preparation Format: DWG, Version, operating in Microsoft Windows operating system.

3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.

4. Design Professional will furnish Contractor one set of digital data files of the Drawings for use in preparing coordination digital data files. Refer to Division 01 Section 013300, "Submittal Procedures".
for digital data file requirements.
   a. Design Professional makes no representations as to the accuracy or completeness of digital
data files as they relate to the Drawings.
   b. Digital Data Software Program: The Drawings are available in [Program].
   c. Contractor shall execute a data licensing agreement in a form agreeable to the Design
   Professional.

1.6 CHANGE KEY PERSONNEL
A. Change Key Personnel Names: Changes to key personnel originally stated in the bid response must include
a revised list of key personnel assignments, including superintendent and other personnel in attendance at
Project site. Identify individuals and their duties and responsibilities: list addresses and telephone numbers,
including home, office, and cellular telephone numbers and email addresses. Provide names, addresses,
and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to
Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary
telephone. Keep list current at all times.
   2. Key personnel must be same as those proposed in the bid response unless changes are authorized
   in writing from the Associate Vice Chancellor for System Facilities prior to their first day on the project.

1.7 REQUESTS FOR INFORMATION (RFIs)
A. General: Immediately on discovery of the need for additional information or interpretation of the Contract
Documents, Contractor shall prepare and submit an RFI. All RFIs should be sent directly to the Design
Professional via email or posted to project collaboration site (if one is being utilized). The Design
Professional will redistribute to the appropriate reviewer.
   1. Design Professional will return RFIs submitted to Design Professional by other entities controlled by
   Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work
   of subcontractors.
B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and
the following:
   1. Project name
   2. Project number
   3. Date
   4. Name of Contractor
   5. Name of Design Professional
   6. RFI number, numbered sequentially
   7. RFI subject
   8. RFI Question
   9. Specification Section number and title and related paragraphs, as appropriate
10. Drawing number and detail references, as appropriate
11. Field dimensions and conditions, as appropriate
12. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the
Contract Sum, Contractor shall state impact in the RFI.
13. Contractor's signature
14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings,
coordination drawings, and other information necessary to fully describe items needing interpretation.
   a. Include dimensions, thicknesses, structural grid references, and details of affected materials,
assemblies, and attachments on attached sketches.
C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to
Design Professional. RFIs should be emailed to Design Professional with the following format standards. 1)
RFI should include RFI number in subject line of email along with brief description. 2) Body of email should
include question or description of RFI and suggestion. Sketches or other necessary documents should be
attached to email in PDF format.
D. Design Professional's Action: Design Professional will review each RFI, determine action required, and
respond. Allow seven (7) business days for Design Professional's response for each RFI. RFIs received
by Design Professional after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
   a. Requests for approval of submittals
   b. Requests for approval of substitutions
   c. Requests for coordination information already indicated in the Contract Documents
   d. Requests for adjustments in the Contract Time or the Contract Sum
   e. Requests for interpretation of Design Professional's actions on submittals
   f. Incomplete RFIs or inaccurately prepared RFIs
2. Design Professional's action may include a request for additional information, in which case Design
3. Design Professional’s action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section 012600, “Contract Modification Procedures”.
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Design Professional in writing within ten (10) days of receipt of the RFI response.

E. On receipt of Design Professional’s action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Design Professional within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Log with not less than the following:
   1. RFI Log Date
   2. Project name
   3. Name and address of Contractor
   4. Name and address of Design Professional and Construction Manager
   5. RFI number including RFIs that were dropped and not submitted
   6. RFI description
   7. Date the RFI was submitted
   8. Request Date
   9. Date Design Professional’s and Construction Manager’s response was received
   10. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate
   11. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Design Professional of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees in advance of meeting.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Design Professional, within three (3) days of the meeting.

B. Pre-construction Conference: Schedule and conduct a pre-construction conference before starting construction, at a time convenient to Owner and Design Professional, but no later than fifteen (15) days after notice to proceed.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, Owner’s Commissioning Authority, Construction Manager, Design Professional, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Distribute the agenda to all invited attendees in advance of meeting. Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule
      b. Phasing
      c. Critical work sequencing and long-lead items
      d. Designation of key personnel and their duties
      e. Lines of communications
      f. Procedures for processing field decisions and Change Orders
      g. Procedures for RFIs
      h. Procedures for testing and inspecting
      i. Procedures for processing Applications for Payment
      j. Distribution of the Contract Documents
      k. Submittal procedures
      l. Sustainable design requirements
      m. Preparation of record documents
      n. Use of the premises [and existing building]
      o. Work restrictions
      p. Working hours
      q. Owner’s occupancy requirements
      r. Responsibility for temporary facilities and controls
      s. Procedures for moisture and mold control
      t. Procedures for disruptions and shutdowns
u. Construction waste management and recycling  
v. Parking availability  
w. Office, work, and storage areas  
x. Equipment deliveries and priorities  
y. First aid  
z. Security  
aa. Progress cleaning  
bb. Commissioning requirements/coordination  

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes within three (3) days of meeting date.

C. Pre-Installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Design Professional of scheduled meeting dates.

2. Agenda: Distribute the agenda to all invited attendees in advance of meeting. Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents  
   b. Options  
   c. Related RFIs  
   d. Related Change Orders  
   e. Purchases  
   f. Deliveries  
   g. Submittals  
   h. Review of mockups  
   i. Possible conflicts  
   j. Compatibility problems  
   k. Time schedules  
   l. Weather limitations  
   m. Manufacturer's written recommendations  
   n. Warranty requirements  
   o. Compatibility of materials  
   p. Acceptability of substrates  
   q. Temporary facilities and controls  
   r. Space and access limitations  
   s. Regulations of authorities having jurisdiction  
   t. Testing and inspecting requirements  
   u. Installation procedures  
   v. Coordination with other work  
   w. Required performance results  
   x. Protection of adjacent work  
   y. Protection of construction and personnel  

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes within three (3) days of meeting date.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct Project closeout conference, at a time convenient to Owner and Design Professional, but no later than [number] days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Authorized representatives of Owner, Design Professional, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Distribute the agenda to all invited attendees in advance of meeting. Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of record documents  
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance
c. Submittal of written warranties

d. Requirements for preparing sustainable design documentation

e. Requirements for preparing operations and maintenance data

f. Requirements for demonstration and training

g. Preparation of Contractor's punch list

h. Procedures for processing Applications for Payment at Substantial Completion and for final payment

i. Submittal procedures

j. Coordination of separate contracts

k. Owner's partial occupancy requirements

l. Installation of Owner's furniture, fixtures, and equipment

m. Responsibility for removing temporary facilities and controls

4. Minutes: Entity conducting meeting will record and distribute meeting minutes within three (3) days of meeting date.

E. Progress Meetings: Conduct progress meetings at agreed upon intervals.

1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: In addition to representatives of Owner, Owner's Commissioning authority, Construction Manager, and Design Professional, each contractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Distribute the agenda to all invited attendees in advance of meeting. Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics as appropriate to status of Project.

   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

   b. Review present and future needs of each entity present, including the following:

      Interface requirements
      Sequence of operations
      Status of submittals
      Deliveries
      Off-site fabrication
      Access
      Site utilization
      Temporary facilities and controls
      Progress cleaning
      Quality and work standards
      Status of correction of deficient items
      Field observations
      Status of RFIs
      Status of proposal requests
      Pending changes
      Status of Change Orders
      Pending claims and disputes
      Documentation of information for payment requests
      Recommendations of construction feasibility
      Safety precautions and programs

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information within three (3) days of meeting date.

   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. Attendees: In addition to representatives of Owner and Design Professional, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings.
participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.

2. **Agenda:** Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. **Combined Contractor’s Construction Schedule:** Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor’s construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   b. **Schedule Updating:** Revise combined Contractor’s construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
   c. **Review present and future needs of each contractor present,** including the following:
      - Interface requirements
      - Sequence of operations
      - Status of submittals
      - Deliveries
      - Off-site fabrication
      - Access
      - Site utilization
      - Temporary facilities and controls
      - Work hours
      - Hazards and risks
      - Progress cleaning
      - Quality and work standards
      - Change Orders

3. **Reporting:** Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting, within three (3) days of meeting date.

4. **Minutes:** Entity responsible for conducting meeting will record and distribute meeting minutes within three (3) days of meeting date.

G. **Meetings Requested by Owner:** While not necessarily coinciding with dates of other meetings, Owner reserves the right to call and conduct meetings with project participants as the need arises.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**
SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor’s Work Progress Schedule
   2. Daily construction reports
   3. Material location reports
   4. Field condition reports
   5. Special reports

1.3 DEFINITIONS
A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and/or controlling the construction project. Activities included in a construction schedule that consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

1.1 Baseline Schedule: The initial time schedule prepared by Contractor for Owner’s information and acceptance that conveys Contractor’s and Subcontractors’ activities (including coordination and review activities required in the Contract Documents to be performed by Design Professional and Owner), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule clearly demonstrates the Longest Path of activities, durations, and necessary predecessor conditions that drive the end date of the schedule. The Baseline Schedule shall not exceed the time limit current under the Contract Documents.

1.2 Longest Path: The sequence of directly related activities that comprise the longest continuous chain of activities from the start of the first activity to the finish of the last activity. The activities represent critical path plus float plus historical weather days. Each activity in the Longest Path is critical and directly related in that it prevents its successor from being scheduled earlier than it is.

B. Event: The starting or ending point of an activity.
C. Work Progress Schedule: The continually updated time schedule prepared and monitored by the Contractor that coordinates and integrates activities of the Project, including Contractor’s services, Design Professional’s services, the work of other consultants, suppliers, and Owner’s activities with the anticipated construction schedules for other contractors. The WPS accurately indicates all necessary and appropriate revisions including a longest path impact analysis, as required by the conditions of the Work and the Project while maintaining a concise comparison to the Baseline Schedule.

D. Float: The period of time a task can be delayed without delaying Substantial Completion date.

1.4 INFORMATIONAL SUBMITTALS
A. Format for Submittals: Submit required submittals in the following format:
   1. PDF electronic file.
B. Contractor’s Baseline Schedule: Initial Baseline Schedule due with Guaranteed Maximum Price in a Construction Manager-At-Risk and with the Proposal Response in a CSP, of size required to display entire schedule for entire construction period. The Baseline Schedule shall become the comparison to the actual conditions throughout the Contract duration and become part of the Contractor’s Work Progress Schedule.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (baseline or updated) and date on label.
C. WPS Reports: Concurrent with WPS schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, and remaining duration in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start
date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity.

3. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

D. Material Location Reports: Submit at prior to application for payment

E. Field Condition Reports: Submit at time of discovery of differing conditions

F. Special Reports: Submit at time of unusual event

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in WPS scheduling and reporting, with capability of producing WPS reports and diagrams within twenty-four (24) hours of Design Professional’s request.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor’s construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR’S WORK PROGRESS SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Procurement Activities: Include procurement process activities for long lead items (as identified by Contractor) and major items, requiring a cycle of more than sixty (60) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section 013300, "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor’s construction schedule with submittal schedule.

3. Startup and Testing Time: Include not less than fifteen (15) days for startup and testing.

4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Design Professional’s administrative procedures necessary for certification of Substantial Completion.

5. Punch List and Final Completion: Include not more than thirty (30) days for punch list and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.

2. Work under More Than One Contract: Include a separate activity for each contract.

3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section 011000, "Summary". Delivery dates indicated stipulate the earliest possible delivery date.

5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section 011000, "Summary". Delivery dates indicated stipulate the earliest possible delivery date.

6. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing conditions

b. Limitations of continued occupancies

c. Uninterruptible services

d. Partial occupancy before Substantial Completion

e. Use of premises restrictions

f. Lead time for future construction

g. Seasonal variations
7. **Work Stages:** Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   
   a. Subcontract awards  
   b. Submittals  
   c. Purchases  
   d. Mockups  
   e. Fabrication  
   f. Sample testing  
   g. Deliveries  
   h. Installation  
   i. Tests and inspections  
   j. Adjusting  
   k. Curing  
   l. Startup and placement into final use and operation

8. **Construction Areas:** Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

   a. Structural completion  
   b. Permanent space enclosure  
   c. Completion of mechanical installation  
   d. Completion of electrical installation  
   e. Substantial Completion

D. **Milestones:** Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. **Cost Correlation:** At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

   1. Refer to Division 01 Section 012900, "Payment Procedures" for cost reporting and payment procedures.

F. **Upcoming Work Summary:** Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

   1. Unresolved issues  
   2. Unanswered RFIs  
   3. Rejected or unreturned submittals  
   4. Notations on returned submittals

G. **Recovery Schedule:** When periodic update indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required for compliance, and date by which recovery will be accomplished.

H. **Computer Scheduling Software:** Prepare schedules using current version of a program that has been developed specifically to manage construction schedules. Confirm acceptability of software with Owner. Contractor is responsible for all costs associated with licensing and training of the software.

I. **Schedule shall be updated with the weekly OAC meeting and must include current details for all activities.**

2.2 **CONTRACTOR’S WORK PROGRESS SCHEDULE (WPS SCHEDULE)**

A. **General:** Contractor shall submit for review and approval a Baseline Schedule that will indicate starting and completing dates of various aspects required to complete the work using the Longest Path. The Baseline Schedule shall become the comparison to the actual conditions throughout the contract and become a part of the Work Progress Schedule.

B. **Contractor’s Work Progress Schedule (WPS):** shall coordinate and integrate the services and activities of Contractor, Design Professional and Owner, other consultants/suppliers, subcontractors and requirements of governmental entities. The WPS is due within twenty-one (21) days after the effective date of Notice to Proceed.

C. **Contractor shall be responsible to:**

   1. Conduct educational workshops to train and inform key Project personnel, including subcontractors’ personnel and Owner’s Representative, in proper methods of providing data and using WPS information.
   2. Establish procedures for monitoring and updating WPS and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   3. Use “one workday” as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to correlate with Contract Time.

D. **WPS Preparation:** Prepare a list of all activities required to complete the Work.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
   a. Preparation and processing of submittals
   b. Mobilization and demobilization
   c. Purchase of materials
   d. Delivery
   e. Fabrication
   f. Utility interruptions
   g. Installation
   h. Work by Owner that may affect or be affected by Contractor's activities
   i. Testing
   j. Punch list and final completion
   k. Activities occurring following final completion

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the WPS within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
   a. Sub-networks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial schedule from a sorted activity list indicating straight “early start”. Identify critical activities. Prepare tabulated reports showing the following:
   1. Contractor or subcontractor and the Work or activity
   2. Description of activity
   3. Principal events of activity
   4. Immediate preceding and succeeding activities
   5. Activity duration in workdays

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
   1. Identification of activities that have changed
   2. Changes in activity durations in workdays
   3. Changes in the critical path
   4. Changes in total float time
   5. Changes in the Contract Time
   6. Show relationship between activities on initial and updated schedule.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report record the following information concerning events at Project site:
   1. List of subcontractors at Project site
   2. List of separate contractors at Project site
   3. Approximate count of personnel at Project site
   4. Equipment at Project site
   5. Material deliveries
   6. High and low temperatures and general weather conditions, including presence of rain or snow
   7. Accidents
   8. Meetings and significant decisions
   9. Unusual events (refer to special reports)
   10. Stoppages, delays, shortages, and losses
   11. Meter readings and similar recordings
   12. Emergency procedures
   13. Orders and requests of authorities having jurisdiction
   14. Change Orders received and implemented
   15. Construction Change Directives received and implemented
   16. Services connected and disconnected
   17. Equipment or system tests and startups
   18. Partial completions and occupancies
   19. Substantial Completions authorized

B. Material Location Reports: Monthly prepare and submit a comprehensive list of materials delivered to and stored at Project site. Include with list a statement of progress on and delivery dates for materials or items...
of equipment fabricated or stored away from Project site.

C. **Field Condition Reports**: Immediately on discovery of a difference between field conditions and the Contract Documents prepare and submit, to the Design Professional, a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. **Executive Summary Reports**: Provided monthly with Payment Applications. Provides highlight details, schedule summary, and other information pertinent to Owner, including, but not limited to the following:
   1. Table of contents, simple project schedule clearly indicating benchmark dates, a narrative stating the current status of construction, a list of construction concerns, a look at what is coming up, potential change order log, and progress photo’s.

### 2.4 SPECIAL REPORTS

A. **General**: Submit special reports directly to Owner within one (1) day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. **Reporting Unusual Events**: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor’s personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR’S WORK PROGRESS SCHEDULE

A. **Scheduling Consultant**: Engage a consultant to provide planning, evaluation, and reporting using WPS scheduling.
   1. **In-House Option**: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in WPS scheduling and reporting techniques. Submit qualifications.
   2. **Meetings**: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. **Contractor’s WPS Updating**: Update and submit the WPS with the OAC meeting minutes to reflect actual construction progress and activities.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

C. **Distribution**: Distribute copies of approved schedule to Design Professional, Owner, commissioning agent, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

**END OF SECTION**
SECTION 013233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for the following:
   1. Pre-construction photographs
   2. Periodic construction photographs
   3. Final completion construction photographs
   4. Owner may elect to retain an independent firm to photographically document the progress of the work. Work of this firm shall not diminish or replace responsibilities of the Contractor for documentation required by this section. Contractor to cooperate fully with independent photographer.

1.3 UNIT PRICES
A. Basis for Bids: Base number of construction photographs on average of twenty (20) photographs per week over the duration of Project.

1.4 INFORMATIONAL SUBMITTALS
A. Digital Photographs: Submit image files within three days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 8 megapixels.
   2. Format: Minimum 1600 by 1200 pixels, 400 dpi minimum, in unaltered original files, with same aspect ratio as the sensor, un-cropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project
      b. Name of Design Professional
      c. Name of Contractor
      d. Date photograph was taken
      e. Description of location, direction (by compass point), and elevation or story of construction

1.5 COORDINATION
A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities.

1.6 USAGE RIGHTS
A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA
A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 1600 by 1200 pixels and 400 dpi.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS
A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.
B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image editing software.
   1. Date and Time: Include date and time in file name for each image.
   2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
C. Pre-construction Photographs: Before commencement of excavation, take photographs of Project site and
surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs
2. Take twenty (20) photographs to show existing conditions adjacent to property before starting the Work.
3. Take twenty (20) photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take twenty (20) photographs monthly (unless otherwise directed), coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Time-lapse Sequence Construction Photographs: Take photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment.
2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
   a. Commencement of the Work, through completion of subgrade construction
   b. Above-grade structural framing
   c. Exterior building enclosure
   d. Interior Work, through date of Substantial Completion

END OF SECTION
SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS
A. Action Submittals: Written and graphic information and physical samples that require Design Professional's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.
B. Informational Submittals: Written and graphic information and physical samples that do not require Design Professional's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.
C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

1.4 ACTION SUBMITTALS
A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Design Professional and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first sixty (60) days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead-time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal
      b. Specification Section number and title
      c. Submittal category: Action, informational
      d. Name of subcontractor
      e. Description of the Work covered
      f. Scheduled date for Design Professional's final release or approval
      g. Scheduled dates for purchasing
      h. Scheduled dates for installation
      i. Activity or event number

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS
A. Design Professional's Digital Data Files: Design Professional will provide electronic copies of CAD Drawings for Contractor's use in preparing coordination submittals.
   1. Design Professional will furnish Contractor one (1) set of drawing files for use in preparing Shop Drawings and Project record drawings.
   2. Design Professional makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
5. CAD files will by furnished for each appropriate discipline.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by Design Professional.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   5. Design Professional reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Design Professional’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. Submittals received after 1:00 pm will be considered to have been received the following day.
   1. Allow ten (10) business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Design Professional will advise Contractor when a submittal being processed must be delayed for coordination. Allow fifteen (15) business days for review time for large or complex submittals will require additional review time. The following are examples but not limited to such submittals, Millwork, Curtain Wall, Structural Steel, Doors, Frames, Hardware (total opening).
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow ten (10) business days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Design Professional’s consultants, Owner, or other parties is indicated, allow fifteen (15) business days for initial review of each submittal.

D. Identification and Information: Place a permanent label or title block on each copy submittal item for identification.
   1. On large format Shop Drawings, Contractor shall stamp each individual page as well as the reviewer’s stamp.
   2. Indicate name of firm or entity that prepared each submittal on label or title block.
   3. Provide a space approximately 6-inches by 8-inches on label or beside title block to record Contractor’s review and approval markings and action taken by Design Professional.
   4. Include the following information for processing and recording action taken:
      a. Project name
      b. Date
      c. Name of Design Professional
      d. Name of Contractor
      e. Name of subcontractor
      f. Name of supplier
      g. Name of manufacturer
      h. Submittal number or other unique identifier, including revision identifier
         1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
            i. Number and title of appropriate Specification Section
            j. Drawing number and detail references, as appropriate
            k. Location(s) where product is to be installed, as appropriate
            l. Other necessary identification

E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. For typical projects that do not require separate submittals for different buildings or sub the submittal file name shall use Specification Section number followed by a dash and then a sequential number. Resubmittals shall include an numerical suffix after another dash. Include
brief description of submittal after sequential number or resubmittal suffix. (e.g., 061000-001-0 Rough Carpentry).

b. For complex projects that require project identifier for separate buildings within a project or require individual submittals to be submitted by multiple subcontractors, the submittal file name shall follow the following: Specification Section number followed by a decimal point and then a sequential number. Resubmittals shall include an alphabetic suffix after another decimal point. Project Identifier should follow in parentheses (e.g., 061000-001-0 (LNHS) Rough Carpentry).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Design Professional.

4. Include the following information on an inserted cover sheet:
   a. Project name
   b. Date
   c. Name and address of Design Professional
   d. Name of Contractor
   e. Name of firm or entity that prepared submittal
   f. Name of subcontractor
   g. Name of supplier
   h. Name of manufacturer
   i. Number and title of appropriate Specification Section
   j. Drawing number and detail references, as appropriate
   k. Location(s) where product is to be installed, as appropriate
   l. Related physical samples submitted directly
   m. Other necessary identification

5. Include the following information as keywords in the electronic file metadata:
   a. Project name
   b. Number and title of appropriate Specification Section
   c. Manufacturer name
   d. Product name

F. Options: Identify options requiring selection by the Design Professional.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Design Professional observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
   1. Submit one (1) copy of submittal to concurrent reviewer in addition to specified number of copies to Design Professional.

I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Design Professional will return submittals, without review, received from sources other than Contractor.
   1. Transmittal Form: Use standard contractor form as approved by Design Professional Owner.
   2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Design Professional on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Include all submitted information from previous submittal in resubmittal, to form a comprehensive document for Design Professional's review.
   4. Resubmit submittals until they are marked with 'Reviewed', 'Furnish as Corrected' notation from Design Professional's action stamp, or with approval notation from alternate reviewer

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals that are marked with 'Reviewed', 'Furnish as Corrected' notation from Design Professional's action stamp, or with approval notation from alternate reviewer.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email or upload electronic submittals as PDF electronic files directly to Design Professional’s Info Exchange Folder specifically established for Project.
2. Action Submittals: For large format drawings and submittals (larger than 11x17), submit PDF file plus two (2) hard copies. For smaller format drawings and submittals (11x17 or less), provide only PDF file. Design Professional will return only the marked-up PDF.
3. Informational Submittals: Submit two paper copies of each submittal, unless otherwise indicated.
   Design Professional will not return copies.
4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section 017700, “Closeout Procedures”.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section 014000, "Quality Requirements".

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts
   b. Manufacturer's product specifications
   c. Standard color charts
   d. Statement of compliance with specified referenced standards
   e. Testing by recognized testing agency
   f. Application of testing agency labels and seals
   g. Notation of coordination requirements
   h. Availability and delivery time information
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring
   b. Printed performance curves
   c. Operational range diagrams
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file

C. Shop Drawings: Prepare Project specific information, drawn accurately to scale.
1. Submittals containing reproduction of Contract Drawings are not considered Shop Drawings and will be returned without action. Any delay due to such rejection will not be grounds for an extension of Contract Time.
2. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products
   b. Schedules
   c. Compliance with specified standards
   d. Notation of coordination requirements
   e. Notation of dimensions established by field measurement
   f. Relationship and attachment to adjoining construction clearly indicated
   g. Seal and signature of professional engineer if specified
3. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
4. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8 ½ -inches by 11-inches but no larger than 30-inches by 42-inches.
5. Submit Shop Drawings in the following format:
   a. For large format drawings and submittals (larger than 11 x 17), submit PDF file plus two (2) hard copies. For smaller format drawings and submittals (11x17 or less), provide only PDF file. Design Professional will return only the marked-up PDF.
D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample
   b. Product name and name of manufacturer
   c. Sample source
   d. Number and title of applicable Specification Section

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit three (3) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Design Professional will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples 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.
   a. Number of Samples: Submit sets of Samples. Design Professional will retain one sample set; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space
   4. Location within room or space
   5. Submit product schedule in the following format:
      a. PDF electronic file

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section 013200, "Construction Progress Documentation".

G. Application for Payment: Comply with requirements specified in Division 01 Section 012900, "Payment Procedures".

H. Schedule of Values: Comply with requirements specified in Division 01 Section 012900, "Payment Procedures".

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.
   4. Submit subcontract list in the following format:
      a. PDF electronic file

J. Coordination Drawings: Comply with requirements specified in Division 01 Section 013100, "Project Management and Coordination".
K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Design Professionals and owners, and other information specified.


M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization
2. Date of evaluation
3. Time period when report is in effect
4. Product and manufacturers' names
5. Description of product
6. Test procedures and results
7. Limitations of use

T. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section 014000, "Quality Requirements".

U. Pre-construction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit reports indicating and interpreting results of field tests either performed during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Maintenance Data: Comply with requirements specified in Division 01 Section 017823, "Operation and Maintenance Data".

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions, other performance and design criteria, and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Design Professional.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three (3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

KIRKSEY 013300 - 6 SUBMITTAL PROCEDURES (O)
PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW
   A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of
      the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark
      with approval stamp before submitting to Design Professional.
   B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section
      017700, "Closeout Procedures".
   C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location,
      submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval,
      and statement certifying that submittal has been reviewed, checked, and approved for compliance with the
      Contract Documents.

3.2 DESIGN PROFESSIONAL'S ACTION
   A. General: Design Professional will not review submittals that do not bear Contractor's approval stamp and
      will return them without action.
   B. Action Submittals: Design Professional will review each submittal, make marks to indicate corrections or
      modifications required, and return it. Design Professional will stamp each submittal with an action stamp and
      will mark stamp appropriately to indicate action, as follows:
      1. Reviewed
      2. Revise and Resubmit
      3. Rejected
      4. Furnish As Corrected
      5. No Action Taken
   C. Informational Submittals: Design Professional will review each submittal and will not return it, or will return
      it if it does not comply with requirements. Design Professional will forward each submittal to appropriate
      party.
   D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has
      received prior approval from Design Professional.
   E. Incomplete submittals are not acceptable, will be considered non-responsive, and will be returned without
      review.
   F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION
SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS LIST

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List Subcontractors and Major Material Suppliers proposed for use on this Project as required by the Construction Documents. Attach supplemental sheets if necessary.

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<th>Contact</th>
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- Section Number
- Section Title
- Firm
- Address
- Phone Number
- Fax Number
- Contact

- [ ] Attachments

Signed by: ____________________________  Date: __________

Copies: □ Owner  □ Consultants  □__________  □__________  □__________  □__________  □__________  □__________  □__________  □ File

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CSI Form 1.5A
SECTION 013516
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes:
   1. Products and installation for patching and extending Work within construction areas of existing facilities.
   2. Providing transition and adjustments
   3. Repair of damaged surfaces and finishes
B. Related Sections include the following:
   1. Division 01 Section 015000 “Temporary Facilities and Controls” for construction of temporary fire-rated partitions to separate existing occupied areas from construction areas.

1.3 OCCUPANCY, ACCESS, AND PROTECTION
A. Entire existing facility or any portion thereof will be occupied during progress of construction for conduct of normal operations. Phase Work in accordance with Section 011000, “Summary”.
B. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage. Perform work not to interfere with operations of occupied areas.
C. Existing facilities will remain in full operation during execution of this Work. Exercise every precaution to ensure safety and protection for existing facilities, occupants, merchandise, pedestrians, and vehicles. The following must meet required codes and accessibility requirements.
   1. Maintain safe access and egress at all times for occupants, pedestrians, and vehicles.
   2. Provide protection to prevent damage to facilities, merchandise, and vehicles from dust, water, weather, and other similar harmful elements. Refer to Section 015000, “Temporary Facilities and Controls” for additional requirements.
   3. Maintain exiting from facilities to provide safe passage complying with applicable codes.

1.4 SCHEDULING OF WORK
A. Make arrangements with Owner and schedule Work to avoid interference with normal operations of occupied areas. Submit schedule and summary of applicable Work within occupied areas and obtain Owner approval not less than two (2) days prior to commencement of such Work.
   1. Requests for use of certain existing loading docks, passage ways, and other similar spaces within areas outside limits of construction operations will be limited to day-by-day basis and must be approved in advance by Owner.
B. Coordinate access and scheduling of Work within tenant areas with Owner.

1.5 TORCH-CUTTING AND WELDING PROCEDURES
A. Notify Owner in advance of torch-cutting and welding operations performed within occupied areas; obtain approval prior to proceeding with such operations.
   1. Neither open-flame torch-cutting, welding nor arc-welding are allowed without having secured appropriate permit from Fire Marshal or authority having jurisdiction.
   2. Keep portable fire extinguisher of appropriate class within reach during welding or torch-cutting operations.
   3. Screen arc-welding from vision of passersby.
B. Maintain a “Fire Watch” for minimum of sixty (60) minutes after completion of each torch-cutting and welding operation.

1.6 UTILITY SERVICE OUTAGES
A. Keep utility and service outages to minimum and perform only after written approval of Owner is received.
   1. Requests for outages will not be considered unless they include an identification of areas which will be affected by proposed outage.
   2. Schedule outages for times other than normal business hours.
   3. Make requests for outages minimum of five (5) calendar days in advance of proposed outage.
B. Contractor: Responsible for investigating utility and service lines to determine effect of outage upon
building operations outside of limit of operations. Obtain approval in advance from Owner to execute investigations.

1.7 KEYS
A. When necessary to perform Work, Owner will issue keys to existing mechanical/electrical equipment spaces.
B. Return keys at end of warranty period.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Type and Quality of Existing Products: Use products or types of construction that exist in structure, as needed to patch, extend, or match existing Work.
   1. Generally, Contract Documents do not define products or standards of workmanship present in existing construction.
   2. Determine by inspecting and testing products where necessary, referring to existing work as quality standard.
B. New Materials: Comply with Specifications for each product involved.
   1. Match existing products and work for patching existing work.
C. Materials for Temporary Fire-Rated Partitions: Comply with provisions of Division 01 Section 015000 “Temporary Facilities and Controls”.
D. Salvaged Materials: Salvage sufficient quantities of cut or removed material to replace damaged Work of existing construction, when material is not readily obtainable on current market.
   1. Store salvaged items in dry, secure place on site.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Comply with provisions of Division 01 Section 017300, “Execution”.
   1. Responsible for verifying existing conditions to determine that all areas meet constructability and are ready for alteration and remodeling.
B. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
   1. Prior to commencing work, carefully compare and check Contract Documents for discrepancies in locations or elevations of work to be executed.
   2. Refer discrepancies among Drawings and existing conditions to Design Professional for adjustment before work affected is performed.

3.2 PREPARATION
A. Construct temporary fire-rated partitions to separate existing occupied areas from construction and alteration areas. Comply with provisions of Division 01 Section 015000, “Temporary Facilities and Controls”.
B. Cut, move, or remove items as necessary for access to alteration and renovation Work.
   1. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, deteriorated masonry and concrete, and other deteriorated materials. Replace materials as specified for finished Work.
   2. Remove debris and abandoned items from area and from concealed spaces.
C. Cutting and Removal: Perform cutting and removal work to remove minimum necessary, and in manner to avoid damage to adjacent work. Cut finish surfaces such as masonry, tile, plaster, or metals by methods to terminate surfaces in straight line at natural point of division.
D. Prepare surfaces and remove surface finishes as necessary to provide for proper installation of new materials and finishes.
E. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.
F. Provide temporary barriers and closures to control operations to prevent spread of dust to occupied portions of building; refer to Division 01 Section 015000, “Temporary Facilities and Controls”.

3.3 INSTALLATION
A. Coordinate Work of alterations and renovations to expedite completion and to accommodate Owner occupancy.
B. Remove, cut, and patch Work in manner to minimize damage and to provide means of restoring products and finishes to specified condition.
   1. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.
C. Install products as specified in individual Specification sections.
D. Where new Work abuts or aligns with existing, perform smooth and even transition to match existing adjacent surface in texture and appearance.
   1. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and request instructions from Design Professional as to method of making transition.

3.4 ADJUSTMENTS
A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to provide smooth plane without breaks, steps, or soffits.
B. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
C. Fit Work at penetrations of surfaces as specified in Division 01 Section 017300, “Execution”.
D. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to application of finishes.

3.5 FINISHES
A. Finish new surfaces as specified in individual Specification sections.
B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.6 CLEANING
A. Comply with Division 01 Section 017700, “Closeout Procedures”. Thoroughly clean areas and spaces affected by Work. Completely remove paint, mortar, oils, putty and items of similar nature.
B. Clean Owner occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner occupied areas immediately.

END OF SECTION
SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for quality assurance and quality control.
B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
1. Specific quality assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality assurance and control services required by Design Professional, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
C. Related Sections:
1. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.3 DEFINITIONS
A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Design Professional.
C. Mockups: Full size physical assemblies that are constructed onsite. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Laboratory Mockups: Full-size, physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
D. Pre-construction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
F. Source Quality Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
G. Field Quality Control Testing: Tests and inspections that are performed onsite for installation of the Work and for completed Work.
H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
J. Experienced: When used with an entity or individual, "experienced" means having successfully completed

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QUALITY REQUIREMENTS (O)
a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS
A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Design Professional and Owner for a decision before proceeding.
B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Professional for a decision before proceeding.

1.5 ACTION SUBMITTALS
A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two (2) dimensions.

1.6 INFORMATIONAL SUBMITTALS
A. Contractor's Quality Control Plan: For quality assurance and quality control activities and responsibilities.
B. Contractor's Quality Control Manager Qualifications: For supervisory personnel.
C. Testing Agency Qualifications: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections
3. Description of test and inspection
4. Identification of applicable standards
5. Identification of test and inspection methods
6. Number of tests and inspections required
7. Time schedule or timespan for tests and inspections
8. Requirements for obtaining samples
9. Unique characteristics of each quality control service

1.7 CONTRACTOR'S QUALITY CONTROL PLAN
A. Quality Control Plan, General: Submit quality control plan within ten (10) days of Notice to Proceed, and not less than five (5) days prior to pre-construction conference. Submit in format acceptable to Design Professional. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality assurance and quality control responsibilities. Coordinate with Contractor's construction schedule.
B. Quality Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality assurance and quality control procedures similar in nature and extent to those required for Project.
1. Project quality control manager may also serve as Project superintendent.
C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
D. Testing and Inspection: Include in quality control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor performed tests and inspections including subcontractor-performed tests and inspections.
   Include required tests and inspections and Contractor's elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections".
3. Owner performed tests and inspections indicated in the Contract Documents including tests and inspections indicated to be performed by the Commissioning Authority, if applicable.
E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Design Professional has indicated as nonconforming or defective.
corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS
A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue
2. Project title and number
3. Name, address, and telephone number of testing agency
4. Dates and locations of samples and tests or inspections
5. Names of individuals making tests and inspections
6. Description of the Work and test and inspection method
7. Identification of product and Specification Section
8. Complete test or inspection data
9. Test and inspection results and an interpretation of test results
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector
13. Recommendations on retesting and re-inspecting

B. Manufacturer’s Technical Representative’s Field Reports: Prepare written information documenting manufacturer’s technical representative’s tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative’s Reports: Prepare written information documenting manufacturer’s factory authorized service representative’s tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory authorized service representative making report.
2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
3. Statement whether conditions, products, and installation will affect warranty.
4. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner’s records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE
A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed.
by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329, and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Pre-construction Testing: Where testing agency is indicated to perform pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality assurance service to Design Professional, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Design Professional.
2. Notify Design Professional five (5) business days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Design Professional's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven (7) days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup in accordance with approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.

M. [Room Mockups: Construct room mockups incorporating required materials and assemblies, finished in accordance with requirements. Provide required lighting and additional lighting where required to enable Design Professional to evaluate quality of the Work. Provide room mockups of the following rooms: ________________________________].

N. [Laboratory Mockups: Comply with requirements of pre-construction testing and those specified in individual Specification Sections in Divisions 02 through 49.]

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will
engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24-hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section 013000, "Submittal Procedures".

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.


1. Notify Design Professional and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Does not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work
2. Incidental labor and facilities necessary to facilitate tests and inspections
3. Adequate quantities of representative samples of materials that require testing and inspecting
4. Facilities for storage and field curing of test samples
5. Delivery of samples to testing agencies
6. Preliminary design mix proposed for use for material mixes that require control by testing agency
7. Security and protection for samples and for testing and inspecting equipment at Project site

H. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having
jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Owner, Design Professional and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Design Professional with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG
A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted
   2. Description of the Work tested or inspected
   3. Date test or inspection results were transmitted to Design Professional
   4. Identification of testing agency or special inspector conducting test or inspection
B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Design Professional’s reference during normal working hours.

3.2 REPAIR AND PROTECTION
A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section 017300, “Execution”.
B. Protect construction exposed by or for quality-control service activities.
C. Repair and protection are Contractor’s responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
   A. Design and construction codes applicable to this project are the following:
      1. National Fire Protection Association (NFPA)
         a. 2015 edition NFPA 1 Fire Code
         d. 2013 edition NFPA 14 Standards for the Installation of Standpipe and Hose Systems
         f. 2013 edition NFPA 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
         g. 2017 edition NFPA 70 National Electric Code
         h. 2013 edition NFPA 72 National Fire Alarm Signaling Code
      2. International Building Code Conference (ICC)
         a. 2015 edition International Building Code,
         b. 2015 edition International Mechanical Code,
         c. 2015 edition International Plumbing Code,
         d. 2015 edition International Fire Code,
            1) Including Municipal fire code amendments of the city where the building is being constructed, pertaining to the following shall be used in the project design and construction:
               i) water supply for fire suppression;
               ii) fire hydrant number and locations;
               iii) fire department access to the building;
               iv) KNOX® key access boxes – contact UNT System Fire Marshal for specifics;
               v) fire department connections;
               vi) fire sprinkler and standpipe systems;
               vii) fire hose connections;
               viii) fire alarm system;
               ix) elevator stretcher requirements;
               x) communication coverage;
               xi) other emergency equipment requirements.
         e. 2015 edition International Fuel Gas Code
      3. Design & Construction Guidelines – The University of North Texas
         c. Questions regarding the Design & Construction Guidelines – The University of North Texas are to be emailed to: Peter.Palacios@unt.edu
      4. Elevator and Escalator Construction
         a. Elevators, Escalators and Related Equipment, Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code, Chapter 74, §74.100 (Effective February 15, 2016).
      5. Accessibility Standards

1 Respectively: City of Denton, TX; City of Ft. Worth, TX.; City of Dallas, TX; City of Frisco, TX
6. Energy Conservation Design Standards for New Construction and Major Renovation Projects:
   a. 2015 edition International Energy Conservation Code (IECC);
   b. Low-Rise Residential Buildings -- use Residential Section of 2015 edition IECC.

7. Water Conservation Standards
   "Water Conservation Design Standards for State Buildings and Institutions of Higher Education Facilities" prepared by SECO, dated April 2016, as the water conservation design standards for any new construction or major renovation project. Download available at: https://comptroller.texas.gov/programs/seco/code/

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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2 Major Renovation Projects: For the purposes of this subchapter, a major renovation project is a building renovation or improvement where the implementation cost associated with energy or water efficiency improvements is $2 million or more, based on the initial engineering cost estimate. 34 Tex. Admin. Code §19.33.

Source Note: The provisions of this §19.33 adopted to be effective August 13, 2002, 27 TexReg 7174; amended to be effective September 28, 2011, 36 TexReg 6303; amended to be effective April 7, 2016, 41 TexReg 2495.

3 Low-Rise Residential Building: Residential buildings not more than three stories in height above grade that includes sleeping accommodations and a separate means of egress, and where the occupants are primarily permanent in nature (30 or more days in occupancy).
SECTION 014200

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS
A. General: Basic Contract definitions are included in the Conditions of the Contract.
B. "Approved": When used to convey Design Professional's action on Contractor's submittals, applications, and requests, "approved" is limited to Design Professional's duties and responsibilities as stated in the Conditions of the Contract.
C. "Directed": A command or instruction by Design Professional. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
G. "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.
H. "Provide": Furnish and install, complete and ready for the intended use.
I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 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 unless otherwise indicated.
C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 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 indicated in Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the United States."
B. Following are acronyms used by Owner in the Contract Documents:
1. A/E: Architect/Engineer
2. AHJ: Authority Having Jurisdiction
3. BOR: Board of Regents
4. CCD: Construction Change Directive
5. CCL: Construction Cost Limitation
6. CMAR: Construction Manager at Risk
7. CSP: Competitive Sealed Proposal
8. DD: Design Development
9. FPE: Fire Protection Engineer
10. GCs: General Conditions
11. GMP: Guaranteed Maximum Price
12. GSF: Gross Square Feet
13. HSP: HUB Subcontractor Plan
14. HUB: Historically Underutilized Business
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<td>15. LA</td>
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<td>16. LEED</td>
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<td>17. LDs</td>
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<td>19. NTP</td>
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<td>21. OCM</td>
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<td>23. PAR</td>
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END OF SECTION
SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES
   A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's own forces, Design Professional, testing agencies, and authorities having jurisdiction.
   B. Sewer Service: Owner will pay sewer service use charges for sewer usage by all entities for construction operations.
   C. Water Service: Owner will pay water service use charges for water used by all entities for construction operations.
   D. Electric Power Service: Owner will pay electric power service use charges for electricity used by all entities for construction operations.
   E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
   F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS
   A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
   B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work. Indicate sequencing of work that requires water, such as sprayed fire-resistant materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
   D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
      Locations of dust-control partitions at each phase of the work
      HVAC system isolation schematic drawing
      Location of proposed air filtration system discharge
      Other dust-control measures
      Waste management plan
      Comply with other requirements on a per Campus basis

1.5 QUALITY ASSURANCE
   A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
   B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
   C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
1.6 PROJECT CONDITIONS
A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner’s acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6-feet high with galvanized steel pipe posts; minimum 2½-inch OD line posts and 2⅞-inch OD corner and pull posts, with 1⅝-inch OD top rails.
B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6-feet high with galvanized steel pipe posts; minimum 2½-inch OD line posts and 2⅞-inch OD corner and pull posts, with 1⅝-inch OD top and bottom rails. Provide galvanized steel bases for supporting posts.
C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
D. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES
A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Design Professional, Construction Manager, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   - Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   - Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
   - Drinking water and private toilet.
   - Coffee machine and supplies.
   - Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   - Lighting fixtures capable of maintaining average illumination of 20 FC at desk height.
C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials apart from building.

2.3 EQUIPMENT
A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   - Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   - Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section 017700 “Closeout Procedures”.
C. Air Filtration Units: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL
A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
Locate facilities to limit site disturbance as specified in Division 01 Section 011000, "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service overhead, unless otherwise indicated. Connect temporary service to Owner's existing power source, as directed by Owner.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

L. Telephone:
   1. Post a list of important telephone numbers.
      Police and fire departments
      Ambulance service
      Contractor's home office
      Architect's office
      Engineers' offices
Owner's office
Principal subcontractors’ field and home offices
Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION
A. General: Comply with the following:
Provide construction for temporary offices, shops, and sheds located within construction area or within 30-feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
Maintain support facilities until Design Professional schedules Substantial Completion inspection.
Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
Prepare subgrade and install sub-base and base for temporary roads and paved areas according to Division 31 Section [Insert Section number], "Earth Moving".
Recondition base after temporary use, including removing contaminated material, re-grading, proof rolling, compacting, and testing.
C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
Protect existing site improvements to remain including curbs, pavement, and utilities.
Maintain access for fire-fighting equipment and access to fire hydrants.
D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
Remove snow and ice as required to minimize accumulations.
F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
Identification Signs: Provide Project identification signs as indicated on Drawings.
Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
Provide temporary, directional signs for construction personnel and visitors.
Maintain and touchup signs so they are legible at all times.
G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section 017419, "Construction Waste Management and Disposal."
H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
I. Temporary Elevator Use: Refer to Division 14 Sections for temporary use of new elevators.
J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
Comply with work restrictions specified in Division 01 Section 011000, "Summary."
B. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 Section [Insert Section number], "Site Clearing."
C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
D. Tree and Plant Protection: Comply with requirements specified in Division 01 Section 015639, "Temporary Tree and Plant Protection."
E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended
warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.

Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.

Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant treated plywood.

Construct vestibule and airlock at each entrance through temporary partition with not less than 48-inch doors. Maintain water-dampened foot mats in vestibule.

Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.

Insulate partitions to control noise transmission to occupied areas.

Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.

Protect air-handling equipment.

Provide walk-off mats at each entrance through temporary partition.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

Prohibit smoking in construction areas.

Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### 3.5 MOISTURE CONTROL

A. Contractor’s Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

- Protect porous materials from water damage.
- Protect stored and installed material from flowing or standing water.
- Keep porous and organic materials from coming into prolonged contact with concrete.
- Remove standing water from decks.
- Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

- Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
- Keep interior spaces reasonably clean and protected from water damage.
- Periodically collect and remove waste containing cellulose or other organic matter.
Discard or replace water-damaged material. Do not install material that is wet. Discard, replace or clean stored or installed material that begins to grow mold. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
- Control moisture and humidity inside building by maintaining effective dry-in conditions.
- Use permanent HVAC system to control humidity.
- Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
  - Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for forty-eight (48) hours are considered defective.
  - Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight (48) hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Design Professional.
  - Remove materials that can not be completely restored to their manufactured moisture level within forty-eight (48) hours.

E. Refer to Section 015300, Mold Prevention Measures, for additional requirements.

3.6 OPERATION, TERMINATION, AND REMOVAL
A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
B. Maintenance: Maintain facilities in good operating condition until removal. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a twenty-four (24) hour basis where required to achieve indicated results and to avoid possibility of damage.
C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   - At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section 017700, "Closeout Procedures."

END OF SECTION
SECTION 015300
MOLD PREVENTION MEASURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes: Administrative and procedural requirements to help prevent mold contamination in construction. This section is in addition to requirements contained in Division 01 Section 015000, "Temporary Facilities and Controls".

1.3 SUBMITTALS
A. Reports: Submit reports required in this Section, including but not limited to the following:
   1. Sightings of existing mold
   2. Window and storefront testing
   3. Moisture contents of materials
   4. Exterior sealant cracks, damage, and deterioration

1.4 QUALITY ASSURANCE
A. Pre-construction Meeting: Review requirements of this Section at Pre-construction Meeting.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
B. Do not bring finish materials into building until building is in a conditioned state. Protect finish materials stored within building. Stage materials off the floor and cover with waterproof covering. Examples of these materials include, but are not limited to, insulation, gypsum products, wall coverings, carpet, ceiling tile, wood products, etc.
C. Remove from Project site damaged materials or materials that have become wet. Do not install such materials.

1.6 PROJECT CONDITIONS
A. Perform daily visual inspections of existing building for existing mold. Report sightings of mold to Architect.
B. Remove water found within building during construction immediately.
   1. Energize lift stations and sump pumps as early in Project as possible. Use temporary pumps if necessary to get water out of building and drain lines.
C. Ventilation:
   1. Verify that existing HVAC system is providing positive pressure in building.
   2. Provide adequate air circulation and ventilation during demolition phase(s).
   3. Seal off return air ducts and diffusers to prevent construction dust and moisture from entering occupied areas and HVAC system.
   4. Provide temporary outside air ventilation as building becomes enclosed.
D. Maintain clean project site, free from hazards, garbage, and debris.
E. Eating, drinking, and smoking are not permitted within building.
F. Slope perimeter grades, both temporary and final grades, away from building structure.
G. Verify that condensate pans drain properly beginning with initial installation.
H. Flash roof penetrations immediately. Do not allow water to penetrate to floor below.
I. Seal window openings prior to window installation with plastic to prevent moisture entry.
J. Sprayed-on Fireproofing: Keep air moving throughout building when using sprayed-on fireproofing.
K. Cover stored and installed ductwork and installed duct openings with plastic to prevent dust, debris, and moisture from entering ductwork. Repair damaged plastic barrier.
L. Do not operate air handling equipment below 60°F supply air temperature until building is 100 percent enclosed.
M. Monitor humidity and temperature for conformance to installation requirements defined by material and equipment manufacturers.
N. Check moisture content of gypsum board prior to applying finishes. Record findings.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 INSTALLATION
A. Roof Drains: Connect roof drains to risers and storm drainage lines as soon as possible.
B. Floor Drains: Connect floor drains as soon as possible. Cover floor drains with tape during construction to keep construction debris from blocking drain. Clean out floor drain lines to mains prior to Substantial Completion.
C. Wall Assemblies:
   1. Install exterior wall insulation, vapor retarder, and gypsum board only after building is enclosed.
   2. Keep bottom of installed gypsum board off floor ½-inch.
D. Cavity Conditions: Clean and inspect cavity conditions prior to covering, sealing, or restricting access. Vacuum-clean cavity spaces prior to covering or enclosing.
E. Spray-On Fireproofing: Remove sprayed-on fireproofing overspray immediately.
F. Plumbing: Pressure test plumbing piping identified as insulated on Project prior to installation of insulation.
G. Roof Mounted Equipment: Inspect rooftop units and other roof-mounted equipment for signs of rain leaks immediately after first rain. Water test with hose immediately after installation. Seal leaks immediately.
H. Windows and Storefront: Water test windows to manufacturer’s and Project Manual’s specifications. Record findings and forward to Architect.
I. Sealants: Inspect exterior sealants for cracks, damage, or deterioration. Record findings and forward to Architect.
J. HVAC Equipment (Permanent HVAC Equipment Used for Temporary Conditioning of Building During Construction Phases): Change filters and clean ductwork interior to remove dirt, dust, debris, and moisture build-up prior to turning Project over to Owner.

3.2 ADJUSTING
A. Remove damaged materials or materials that have become wet. Replace with new materials.

3.3 DEMONSTRATION
A. Train and educate Owner’s maintenance personnel on use of building systems. Explain how improper operation and shutting down systems during off periods can create mold problems.
B. Schedule with Owner a review of building for mold problems at 1-year warranty walk-through. Inspect exterior sealants and masonry joints for cracks and other damage or deterioration where water can penetrate building envelope.
C. Explain to Owner the need for Owner to establish annual building review for mold.

END OF SECTION
SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.3 DEFINITIONS
A. Caliper: Diameter of a trunk measured by a diameter tape at 6-inches above the ground for trees up to, and including, 4-inch size; and 12-inches above the ground for trees larger than 4-inch size.
B. Plant Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
C. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples for Verification: For each type of the following:
   2. Protection Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning
   4. Description of pruning to be performed
   5. Description of maintenance following pruning
D. Qualification Data: For qualified arborist and tree service firm.
E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
F. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes pre-construction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE
A. Arborist Qualifications: Certified Arborist as certified by ISA.
B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
C. Pre-installation Conference: Will conduct conference at Pre-Construction Meeting.
   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
      b. Enforcing requirements for protection zones
      c. Arborist's responsibilities
      d. Field quality control
1.6 PROJECT CONDITIONS
A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material
   2. Parking vehicles or equipment
   3. Foot traffic
   4. Erection of sheds or structures
   5. Impoundment of water
   6. Excavation or other digging unless otherwise indicated
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
B. Do not direct vehicle or equipment exhaust toward protection zones.
C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, or gray than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.
   1. Obtain topsoil only from well-drained sites where topsoil is 4-inches deep or more; do not obtain from bogs or marshes.
B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of the following:
   1. Type: Shredded hardwood, fully composted.
   2. Size Range: 3-inches maximum, ½ -inch minimum
   3. Color: Natural
C. Protection Zone Fencing: Fencing fixed in position and meeting the following requirements (previously used materials may be used when approved by Architect):
   1. Protection Zone Fencing: 4’ tall, heavy duty HDPE, high visibility orange, safety fencing, with rigid metal t-posts, minimum 6’ tall installed 2’ into the ground

PART 3 - EXECUTION

3.1 EXAMINATION
A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION
A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54-inches above the ground.
B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
C. Tree Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
   1. Apply 3-inch average thickness of organic mulch. Do not place mulch within 6-inches of tree trunks.

3.3 TREE AND PLANT PROTECTION ZONES
A. Protection Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
1. Locate buried utilities and irrigation around trees and adjust tree protection fencing to miss utilities and maintain irrigation system as required before setting tree protection fencing.
2. Safety Fencing: Install and maintain throughout the duration of construction.
3. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
4. Access Gates: Install as necessary; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Maintain protection zones free of weeds and trash.
C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner and time period approved by Architect.
D. Maintain protection zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
1. Do not remove protection zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to pre-approval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION
A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 “Earth Moving”.
B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tangle under the roots by drilling, auger boring, air spade, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
C. Where construction is required within the tree protection zone, provide 2”X4” wood barrier around the trunk of the tree. Replace barrier fencing as soon as possible after work in the tree protection zone is complete.
D. Redirect roots in backfill areas where possible. If encountering large roots, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3-inches back from new construction and as required for root pruning.
E. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING
A. Prune roots that are affected by temporary and permanent construction.
1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Coat cut ends of roots more than 1-inch in diameter with an approved root sealant.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible.
6. Root Pruning at Edge of Protection Zone: Prune roots 12-inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation
B. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING
A. Prune branches that are affected by temporary and permanent construction.
1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system at the direction of the Owner and Architect. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:

KIRKSEY
3. Type of Pruning: Cleaning.
   b. Specialty Pruning: Restoration.

3. Cut branches with sharp pruning instruments; do not break or chop.

4. Apply pruning paint to wounds.

3.7 REGRADING
A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
D. Minor Fill within Protection Zone: Where existing grade is 2-inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL
A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT
A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
   1. Submit details of proposed root cutting and tree and shrub repairs.
   2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
   4. Perform repairs within 24 hours.
   5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.
B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
   2. Provide one (1) new tree(s) of 6-inch caliper size for each tree being replaced that measure more than 6-inches in caliper size.
      a. Species: Species selected by Architect.
   3. Plant and maintain new trees as specified in Division 32 “Landscape Planting”.
   Aerate 10 feet beyond drip line and no closer than 36-inches to tree trunk. Use Air Spade Technology, 12-inches deep for aeration.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS
A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION
SECTION 015713
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes providing temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements of authorities having jurisdiction. Temporary measures include the following:
   1. Silt fences and straw bales
   2. Sediment barriers and check dams
   3. Stabilized construction entrance
   4. Construction of temporary swales and sedimentation basins as required
   5. Seeding, sodding, and hydro mulching
B. Comply with all local, state, and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System (NPDES) regulations from the Federal Clean Water Act.
C. Should any provisions of this section be at variance with erosion control plan prepared by the civil engineer, the civil engineer’s directive shall take precedence.

1.2 NOTICE OF INTENT
A. Contractor shall submit an EPA Notice of Intent (NOI) prior to construction.
B. Contractor shall prepare the report, coordinate with Owner, and file in accordance with regulations.

PART 2 - PRODUCTS

2.1 SILT FENCE
A. Filter Fabric: Non-woven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36-inches wide.
B. Wire Fence Support: Welded wire fabric 2 x 4 - W1.0 x W1.0.
C. Fence Posts: Painted or galvanized steel Tee or Y-posts with anchor plates, not less than 5-feet in length with a minimum weight of 1.3 pounds per foot. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A-702.

2.2 STRAW BALES
A. Standard rectangular straw bales bound by baling wire (NO TWINE).

2.3 SEDIMENT TRAPS
A. Standard manufacture designed to fit the intended inlet.

2.4 STABILIZED CONSTRUCTION ENTRANCE
A. Aggregate: Graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448 and TEX 401-A coarse-aggregate; with 0 percent being retained by a 5-inch sieve and 100 percent being retained by a 3-inch sieve.

2.5 GRASS
A. Materials and seeding and sodding shall conform to applicable Division 32 section.

2.6 FERTILIZER
A. Use commercial grade fertilizers to insure germination and growth. Analysis by weight shall be 16-4-8 or 15-5-10 for Nitrogen, Phosphoric Acid and Potash.

2.7 WATER
A. Use clean potable water for maintaining the grass.
PART 3 - EXECUTION

3.1 GENERAL
A. Keep disturbed areas to a minimum required to adequately perform the work. At all times, maintain the site in such a manner that minimizes erosion of the site. The execution of work under this section shall be in conformance with the NPDES rulings and the site Storm Water Pollution Prevention Plan.

3.2 SILT FENCES
A. Silt fence shall be a minimum of 24-inches high. Posts shall be embedded a minimum of 12-inches in the ground, placed a maximum of 8-feet apart and set on a slight angle toward the anticipated runoff source.
1. When directed by the Engineer or designated representative, posts shall be set at specified intervals to support concentrated loads.
B. Securely attach filter fabric to posts and wire support fence, with the bottom 12-inches of filter fabric buried in a trench a minimum of 6-inches deep and 6-inches wide to prevent sediment from passing under the fence.
1. When silt fence is constructed on impervious material, a 12-inch flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss.
2. No horizontal joints will be allowed in the filter fabric.
3. Vertical joints shall be overlapped a minimum of 12-inches with the ends sewn or otherwise securely tied.
C. Silt fence shall be maintained for the duration of the project, and repaired, replaced, and/or relocated when necessary or as directed by the Engineer or designated representative. Accumulated silt shall be removed when it reaches a depth of 6-inches

3.3 EROSION CONTROL BARRIERS
A. Provide erosion control barriers at intervals along swales and ditches as shown on the Drawings or as necessary to meet the requirements of the Storm Water Pollution Prevention Plan.
B. Barriers: Silt fence or straw bales placed as indicated on the Drawings.
C. Maintain barriers in good working condition and replace when damaged.

3.4 STABILIZED CONSTRUCTION ENTRANCE
A. Remove brush, stumps, obstructions, and other objectionable material and dispose of in a manner that will not interfere with the excavation, grading, and construction of the entrance as indicated on the Drawings.
1. Stabilized construction entrance shall not drain onto the public right-of-way and shall not allow surface water runoff to exit the construction site.
2. When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way.
   a. When vehicle washing is required, it shall be done on an area stabilized with crushed stone, which drains into an approved sediment trap or sediment basin.
3. Sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence or other methods approved by the Engineer or designated representative.
B. The entrance shall be maintained in a condition that will prevent tracking or disposition of sediment onto public right-of-way. Provide periodic top dressing with additional stone as conditions demand, as well as the repair and/or cleanout of any measures used to trap sediment. Sediment that is spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

3.5 TEMPORARY AND PERMANENT SWALES
A. Description:
1. Provide temporary and permanent drainage swales as required to carry drainage away from the work area to an approved outfall point.
2. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least 2-feet deep with a slope of 0.1 percent.
3. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.
4. Swales shall have erosion control barriers as required.
5. All permanent swales shall be sodded to a minimum width of 10-feet on either side of the centerline of the swale.
B. Maintenance:
1. During the course of construction maintain temporary swales constructed for this contract so as to
allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, place temporary swales to remain in good working condition.

2. Work with other contractors at the site in maintaining existing swales and ditches.

3. Where necessary for access to the work areas install adequately sized culverts and maintain to provide the access without disturbing the site drainage.

4. Take care not to rut and damage sodded swales. Immediately repair damaged swales.

5. Keep sodded swales mowed.

3.6 DRAINAGE DITCHES

A. Immediately hydro mulch drainage ditches upon final grading.

B. Repair erosion of the banks of the drainage ditches immediately and re-stabilize.

C. Place sediment barriers at intervals along the ditch as shown on the plans or as necessary to help trap sediment on the site. Remove sediment and other debris trapped by the barriers daily.

D. Maximum Ditch Side Slopes: 3-feet horizontal to 1-foot vertical.

E. Maintenance of the ditches during construction shall include but not be limited to mowing, re-grading, sediment removal, re-hydro mulching, bank repair, and debris removal.

F. Sediment removed from the ditches may be re-spread on the site as directed by the Owner.

3.7 FILL AND CUT SLOPES

A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's soils engineer.

B. When cut slopes exceed 2:1 for depths over 3-feet, proper bracing and shoring per OSHA requirements shall be used and maintained.

C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydro mulching, sodding, seeding, or other method as approved.

3.8 SEDIMENTATION BASINS

A. Description:

1. Provide sedimentation ponds where indicated.

2. Route drainage from cleared areas through the sedimentation basin.

3. Operate and maintain the pond during construction.

B. Maintenance:

1. Maintain the pond and the outfall and sediment-retarding structure in good working condition throughout the time the pond is to be in operation.

2. When sediment and debris fill the pond to over one third (1/3) its' designed capacity, clean out the pond.

3. Stockpile, in its' own separate area, the sediment from the clearing operation, or remove from the site, as required. Make adequate drainage provisions such that drainage from the sediment stockpile drains back into the sediment pond. When approved by the Owner, sediment removed from the pond may be spread over the site.

3.9 SEEDING

A. Seed disturbed portions of the site and stockpile areas within fourteen (14) days if the phasing of the construction operations is anticipated to leave those portions of the areas unworked for twenty-one (21) days or more.

B. Maintain seeded areas until the Owner accepts the project. Maintain by watering, fertilizing, reseeding, mowing and erosion repair as may be required. Cut grass when the average height of the grass reaches 4-inches. Clippings may be mulched back into the seeded areas.

END OF SECTION
SECTION 015720

INDOOR AIR QUALITY PLAN DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Requirements to develop and utilize an indoor air quality plan for the construction operation.
   2. A sample plan applicable to all interior construction and trades.
   3. Reference:

1.2 TRAINING
A. Contractor shall provide copies of the plan and training to all subcontractors and appropriate personnel.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXECUTION
A. Contractor shall utilize a plan to protect the indoor environments from contamination during construction and finish out similar to the following plan.
B. Contractor shall enforce and verify compliance by all personnel and subcontractors.
C. Contractor shall take pictures of the related construction operations to verify conformance to each section of the plan. These pictures will be provided to the Architect. A minimum of eighteen (18) pictures (six (6) pictures taken on three (3) separate occasions) will be submitted.

3.2 INDOOR AIR QUALITY PLAN DURING CONSTRUCTION OPERATIONS
A. Introduction
   1. This plan outlines the processes required to assure acceptable air quality. Elements of the program include:
      a. HVAC Protection and Containing the work area
      b. Source Control and Modifying HVAC Operation and Reducing Emissions
      c. Pathway Interruptions
      d. Intensifying Housekeeping
      e. Scheduling or Relocation of Occupants

3.3 THESE REQUIREMENTS APPLY TO ALL PARTIES INVOLVED IN DESIGN, CONSTRUCTION, AND BUILDING MOVE IN:
A. CONTAMINANTS
   1. Air contaminants include many different materials. These may include: gases, vapors, chemicals, mold/fungus, pathogens, allergens, particulates and radiation. Eliminating all of these is not possible but reducing the introduction and distribution of these contaminants is possible and desirable. The programs outlined in the following pages are intended to reduce contaminants and provide as clean a building as possible for the residents.
   2. The following sections outline procedures and precautions to reduce building contamination and meet the requirements for a healthy environment.

B. CONSTRUCTION OPERATIONS
   1. HVAC PROTECTION: The air conditioning system is the distribution method for air and potential contaminants throughout the building. Keeping the system clean is a necessity.
      a. All air handling equipment, spiral and fabricated ducts and accessories shall be kept clean during transportation, storage and assembly.
      b. All lined, spiral and assembled ducts shall be wrapped and protected from dirt and water during transportation and storage.
      c. All insulation and lined duct shall be kept dry at all times. Any insulation that has become wet shall be removed and replaced.
      d. Fiberglass duct board in the air handlers and bases shall be kept dry and clean. Exposed fiberglass subject to erosion shall be coated with a sealer to prevent the entry of raw fiberglass into the air stream.
1) Water will not be allowed to stand on any mechanical equipment.
   e. All open ends of installed duct and equipment shall be covered and sealed to prevent the entry of dirt.
   f. All zone boxes shall be wrapped and sealed from dirt and water before installation. Installed zone boxes shall have the openings sealed until permanently connected to the ductwork.
   g. All dampers and attenuators into open chases and ducts shall be covered to reduce dirt entry.
   h. The air handlers shall not be started without MERV 8 filtration in place. Upon system activation, install sheet media on all return openings and filters in zone box plenum openings. These filters must be monitored and changed as necessary to prevent the entry of dirt into the system. The temporary media shall be removed after building flush out and before occupancy.
   i. The return air system should not be used during sheet rock installation, sanding or painting operations.
   j. The building should be kept under a positive pressure as much as possible.
   k. Chase dampers shall be kept closed until the system is activated.
   l. Complete the initial mechanical checklists at system startup.
   m. Replace final filters with new filters before flush out or occupancy per design requirements.

2. SOURCE CONTROL
   a. No smoking or tobacco materials shall be allowed on all campuses.
   b. No gasoline or fuel-fired equipment shall be used inside any enclosed building.
   c. Wet processes within the building shall be kept to a minimum.
   d. All chase and wallboard materials shall be protected from water. All damaged materials shall be removed and replaced.
   e. Use low-emission materials and chemicals.
   f. All cleaning involving chemicals shall be performed outside the building wherever possible.
   g. All carpet materials shall be unrolled or unboxed and aired out in a well-ventilated warehouse for a minimum of three days before installation.
   h. All modular furniture shall be aired out in a well-ventilated warehouse for seven days before entry into the building.
   i. Trash shall be cleaned up and removed daily to the appropriate recycle container.
   j. Any mold growth shall be treated according to the procedures shown in the New York City Department of Health “Guidelines on Assessment and Remediation of Fungi in Indoor Environments”.
   k. Clean the inside of all walls at the base track to remove excess materials and dirt with a vacuum cleaner before enclosing the wall. This is particularly critical on walls with plumbing or water piping included.
   l. HEPA vacuum all concrete floors before installation of floor covering materials.
   m. No obvious mold or chemical contamination shall be enclosed, hidden or painted.

3. PATHWAY INTERRUPTION
   a. Dust-producing operations shall be exhausted to the outside to the extent possible.
   b. Exhaust fans may be installed on each floor to remove dust and contaminants.
   c. The air handler shall supply conditioned air to the floors. Floors with heavy dust or chemical operations shall be exhausted to the outside.
   d. During rain or high-humidity conditions, the air supply coming from the coils shall be cooled to 55°F or the air handler stopped to prevent moist air entry into the building. Exhaust fans shall not draw moist air into the building. It is preferable to have little airflow to moist air entering the building.
   e. Return air dampers and openings shall be covered with filter media during operations that may contaminate the system.
   f. During activities producing airborne particulates in occupied buildings undergoing renovation, or projects whose airspace is connected to occupied buildings, dust producing activities such as, but not limited to, demolition, sanding, buffing, and welding, the Contractor will provide commercial high volume air scrubbers at the rate of 1 per 7000 square feet, operate them continuously, and service them per the manufacturer, including high-efficiency particulate arrestance (HEPA) filter replacement.

4. HOUSEKEEPING
   a. Food or food residues shall be properly disposed after meals or breaks.
   b. Once the building is enclosed with finishes applied, keep dirt entry to a minimum with walk off mats at all entrances. Clean the mats at least daily.
   c. All sweeping shall be done with dust reducing wax-based sweeping compounds.
   d. All materials shall be kept clean and stored neatly on dunnage or pallets as required by the manufacturer.
e. Coils, fans, and air handler chambers, including return air chambers, shall be inspected and cleaned if required before start up, final testing and commissioning, and air testing.

f. All workers shall utilize the proper personal protective equipment per OSHA standards during any operation involving chemicals and dust production.

g. No food, drink, or smoking shall be allowed within the building after the building is enclosed.

5. SCHEDULING
   a. Complete all dust producing and chemical operations before the installation of “sink” materials such as carpet and ceiling tile.
   b. Complete the HVAC control system sufficient to allow the operation of the supply and exhaust systems to control pressurization and contaminants.
   c. Group contaminating operations where possible to maximize exhaust use.

END OF SECTION
SECTION 015720 - INDOOR AIR QUALITY PLAN DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Requirements to develop and utilize an indoor air quality plan for construction and preoccupancy.
   2. A sample plan applicable to all interior construction and trades.
   3. Reference:

1.2 TRAINING
A. Contractor shall provide copies of the plan and training to all subcontractors and appropriate personnel.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXECUTION
A. Utilize a plan to protect the indoor environments from contamination during construction and preoccupancy similar to the following plan.
B. Enforce and verify compliance by personnel and subcontractors.
C. Photograph the related construction operations to verify conformance to each section of the plan. Provide photographs to the Architect. Submit a minimum of 18 photographs, (six taken on three separate occasions). Each set of photos shall be date stamped, highlighting the indoor air protection measures listed in paragraph 3.2A1a-e below.

3.2 INDOOR AIR QUALITY PLAN DURING CONSTRUCTION OPERATIONS
A. Introduction
   1. This plan outlines the processes required to assure acceptable air quality. Elements of the program include:
      a. HVAC Protection and Containing the work area,
      b. Source Control and Modifying HVAC Operation and Reducing Emissions,
      c. Pathway Interruptions,
      d. Intensifying Housekeeping, and
      e. Scheduling or Relocation of Occupants.

3.3 THESE REQUIREMENTS APPLY TO ALL PARTIES INVOLVED IN DESIGN, CONSTRUCTION, AND BUILDING MOVE IN:
A. CONTAMINANTS
   1. Air contaminants include many different materials. These may include; gases, vapors, chemicals, mold/fungus, pathogens, allergens, particulates and radiation. Eliminating all of these is not possible but reducing the introduction and distribution of these contaminants is possible and desirable. The programs outlined in the following pages is intended to reduce contaminants and provide as clean a building as possible for the residents.
   2. The following sections outline procedures and precautions to reduce building contamination and meet the requirements for a healthy environment.
B. CONSTRUCTION OPERATIONS
   1. HVAC PROTECTION: The air conditioning system is the distribution method for air and potentially contaminants throughout the building. Keeping the system clean is a necessity.
      a. All air handling equipment, spiral and fabricated ducts and accessories shall be kept clean during transportation, storage and assembly. All equipment, ductwork, and accessories stored on-site shall be raised off of the floor on pallets.
b. All lined, spiral and assembled ducts shall be wrapped and protected from dirt and water during transportation and storage. All equipment, ductwork, and accessories stored on site shall be raised off of the floor or ground on pallets.

c. All insulation and lined duct shall be kept dry at all times. Any insulation that has become wet shall be removed and replaced.

d. Fiberglass ductboard in the air handlers and bases shall be kept dry and clean. Exposed fiberglass subject to erosion shall be coated with a sealer to prevent the entry of raw fiberglass into the air stream.

1) Water will not be allowed to stand on any mechanical equipment.

e. All open ends of installed duct and equipment shall be covered and sealed to prevent the entry of dirt.

f. All zone boxes shall be wrapped and sealed from dirt and water before installation. Installed zone boxes shall have the openings sealed until permanently connected to the ductwork.

g. All dampers and attenuators into open chases and ducts shall be covered to reduce dirt entry.

h. The air handlers shall not be started without filtration media with a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE 52.2-2007, with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779-2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance) installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media. These filters must be monitored and changed as necessary to prevent the entry of dirt into the system. The temporary media shall be removed after building flush out and before occupancy.

i. The return air system should not be used during sheet rock installation, sanding or painting operations.

j. The building should be kept under a positive pressure as much as possible.

k. Chase dampers shall be kept closed until the system is activated.

l. Complete the initial mechanical checklists at system startup.

m. Replace final filters with new filters before flush out or occupancy per design requirements.

2. SOURCE CONTROL

a. No smoking or tobacco materials shall be allowed in the building and within 25 feet of the building entrance during construction.

b. No gasoline or fuel fired equipment shall be used inside any enclosed building.

c. Wet processes within the building shall be kept to a minimum.

d. All chase and wallboard materials shall be protected from water. All damaged materials shall be removed and replaced.

e. Use low emission materials and chemicals.

f. All cleaning involving chemicals shall be performed outside the building wherever possible.

g. All carpet materials shall be unrolled or unboxed and aired out in a well-ventilated warehouse for a minimum of three days before installation unless the carpet meets the requirements of The Carpet and Rug Institute (CRI) Green label Plus program and the cushion meets the requirements of The Carpet and Rug Institute (CRI) Green label program. Carpet and cushion should be installed a minimum of three days prior to conducting indoor air quality testing. Carpet materials shall be unrolled or unboxed and aired out in a well-ventilated warehouse for a minimum of three days before installation.

h. All modular furniture shall be aired out in a well-ventilated warehouse for seven days before entry into the building unless the modular furniture is Greenguard certified.

i. Trash shall be cleaned up and removed daily to the appropriate recycle container.

j. Any mold growth shall be treated according to the procedures shown in the New York City Department of Health “Guidelines on Assessment and Remediation of Fungi in Indoor Environments.”

k. Clean the inside of all walls at the base track to remove excess materials and dirt with a vacuum cleaner before enclosing the wall. This is particularly critical on walls with plumbing or water piping included.

l. HEPA vacuum all concrete floors before installation of floor covering materials.

m. No obvious mold or chemical contamination shall be enclosed, hidden or painted.

3. PATHWAY INTERRUPTION

a. Dust producing operations shall be exhausted to the outside to the extent possible.

b. Exhaust fans may be installed on each floor to remove dust and contaminants.

c. The air handler shall supply conditioned air to the floors. Floors with heavy dust or chemical operations shall be exhausted to the outside.
d. During rain or high humidity conditions, the air supply coming from the coils shall be cooled to 55 degrees F or the air handler stopped to prevent moist air entry into the building. Exhaust fans shall not draw moist air into the building. It is preferable to have little airflow to moist air entering the building.
e. Return air dampers and openings shall be covered with filter media during operations that may contaminate the system.

4. HOUSEKEEPING
a. Food or food residues shall be properly disposed after meals or breaks.
b. Once the building is enclosed with finishes applied, keep dirt entry to a minimum with walk off mats at all entrances. Clean the mats at least daily.
c. All sweeping shall be done with dust reducing wax-based sweeping compounds.
d. All materials shall be kept clean and stored neatly on dunnage or pallets as required by the manufacturer.
e. Coils, fans, and air handler chambers including return air chambers shall be inspected and cleaned if required before start up, final testing and commissioning, and air testing.
f. All workers shall utilize the proper personal protective equipment per OSHA standards during any operation involving chemicals and dust production.
g. No food, drink, or smoking shall be allowed within the building after the building is enclosed.

5. SCHEDULING
a. Complete all dust producing and chemical operations before the installation of "sink" materials such as carpet and ceiling tile.
b. Complete the HVAC control system sufficient to allow the operation of the supply and exhaust systems to control pressurization and contaminants.
c. Group contaminating operations where possible to maximize exhaust use.

END OF SECTION
SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers’ standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term “product” includes the terms “material”, “equipment”, “system”, and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, which is current as of date of the Contract Documents.

   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words “basis-of-design product”, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

   2. Design Professional’s Action: If necessary, Design Professional will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Design Professional will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

      a. Form of Approval: As specified in Division 01 Section 013300, "Submittal Procedures".

      b. Use product specified if Design Professional does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section 013300, "Submittal Procedures”. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer’s written instructions.

B. Delivery and Handling:

   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container...
or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements under cover in a weather-tight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer’s written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner’s construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer’s disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer’s Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer’s Standard Form: Modified to include Project specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section 017700, “Closeout Procedures”.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected", Design Professional will make selection.


6. Or Equal: For products specified by name and accompanied by the term "or equal", or "or approved equal", or "or approved", comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor’s convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor’s convenience will not be considered.

3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable
products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.

b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
   b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Design Professional's sample", provide a product that complies with requirements and matches Design Professional's sample. Design Professional's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section 012500, "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Design Professional from manufacturer's full range" or similar phrase, select a product that complies with requirements. Design Professional will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Design Professional will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, it is consistent with the Contract Documents, will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of Design Professionals and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)
SECTION 017300

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
      1. Construction layout
      2. Field engineering and surveying
      3. Installation of the Work
      4. Cutting and patching
      5. Coordination of Owner installed products
      6. Progress cleaning
      7. Starting and adjusting
      8. Protection of installed construction
      9. Correction of the Work

1.3 DEFINITIONS
   A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
   B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For land surveyor
   B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
   C. Certified Surveys: Submit two (2) paper copies that are certified, sealed and signed by a Texas registered professional land surveyor. Also submit one copy of the survey in CAD format using surface coordinates and one copy of the survey in CAD format using grid coordinates. Coordinate with Owner for the reference coordinate system and CAD guidelines.
   D. Final Property Survey: Submit one (1) digital copy that is certified, sealed and signed by a Texas registered professional land surveyor showing the Work performed. Also submit one copy of the survey in CAD format using surface coordinates and one copy of the survey in CAD format using grid coordinates. Coordinate with Owner for the reference coordinate system and CAD guidelines.

1.5 QUALITY ASSURANCE
   A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
   B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
      1. Structural Elements: When cutting and patching structural elements, notify Design Professional of locations and details of cutting and await directions from the Design Professional before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
      2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety. Operational elements include the following:
         a. Primary operational systems and equipment
         b. Fire separation assemblies
         c. Air or smoke barriers
         d. Fire-suppression systems
         e. Mechanical systems piping and ducts
         f. Control systems
         g. Communication systems
         h. Conveying systems
         i. Electrical wiring systems
         j. Operating systems of special construction
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, which results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers
   b. Membranes and flashings
   c. Exterior curtain-wall construction
   d. Equipment supports
   e. Piping, ductwork, vessels, and equipment
   f. Noise- and vibration-control elements and systems
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Design Professional’s opinion, reduce the building’s aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer’s Installation Instructions: Obtain and maintain onsite manufacturer’s written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY
A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS
A. General: Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, utilize products for patching that comply with requirements of Division 01 Section 018114, "Sustainable Design Requirements".
B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Design Professional for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work. Surveyor will perform a Locative Survey (Category 3) according to the standards set by the Texas Society of Professional Surveyors Manual of Practice.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
   3. Collect and depict all utility infrastructure according to the Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data published by the American Society of Civil Engineers, publication number CI/ASCE 38-02. All utility data must have a quality level clearly associated, either via a geospatial database, CAD layering, plan symbols, and/or plan labels per the guidelines. Design Professional or Engineer will work with Owner to explain and detail costs and benefits so as to achieve the highest quality levels of subsurface utility engineering applicable to the Project and Work.
B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
a. Description of the Work  
b. List of detrimental conditions, including substrates  
c. List of unacceptable installation tolerances  
d. Recommended corrections  

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.  
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.  
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.  
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.  

3.2 PREPARATION  
A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.  
B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.  
C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.  
D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Design Professional according to requirements in Division 01 Section 013100, "Project Management and Coordination".  

3.3 CONSTRUCTION LAYOUT  
A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Design Professional promptly.  
B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.  
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.  
   2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.  
   3. Inform installers of lines and levels to which they must comply.  
   4. Check the location, level, and plumb of every major element as the Work progresses.  
   5. Notify Design Professional when deviations from required lines and levels exceed allowable tolerances.  
   6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.  
C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.  
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.  
E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Design Professional.  

3.4 FIELD ENGINEERING  
A. Identification: Owner will identify existing benchmarks, control points, and property corners.  
B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.  
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Owner and Design Professional. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Design
Professional before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish, construct and maintain a minimum of two permanent benchmarks on Project site, referenced to Owner’s established geographic coordinate system. Benchmarks will function as both horizontal and vertical benchmarks. A registered professional land surveyor must establish the new benchmarks to meet specifications of National Geodetic Survey (NGS) Class RT1 surveys per the latest version of the User Guidelines for Single Base Real Time GNSS Positioning publication. New and re-set benchmarks will comply with the guidelines specified by Appendix B of the Bench Mark Reset Procedures document published by the NGS agency.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Mapping As-built Conditions: Once inspected and approved by Owner, all underground utility locations will be mapped using GPS mapping equipment to decimeter precision or better, prior to backfill, to collect geospatial data on as-built conditions. Any work covered prior to mapping will be required to be uncovered at no cost or schedule impact to the project. Consult with Owner for guidelines on how to collect the geospatial data and what information needs to be recorded about each utility feature. This information will be incorporated into the project record drawings to indicate the horizontal and vertical location of facilities, easements and improvements, as built.

3.5 INSTALLATION
A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory-prepared and field-installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Design Professional.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. 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 Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING
A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching.
operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section 011000, "Summary".

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned; bypass such services/systems before cutting to prevent interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
2. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80°F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Utilize containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
B. Site: Maintain Project site free of waste materials and debris.
C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly,
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section 015000, “Temporary Facilities and Controls” and Division 01 Section 017419, “Construction Waste Management and Disposal”.
H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
3.9 STARTING AND ADJUSTING
A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section 019113, “General Commissioning Requirements”.
B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section 014000, “Quality Requirements”.
3.10 PROTECTION OF INSTALLED CONSTRUCTION
A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
B. Comply with manufacturer's written instructions for temperature and relative humidity.
3.11 CORRECTION OF THE WORK
A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
B. Restore permanent facilities used during construction to their specified condition.
C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.
END OF SECTION
SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and
      other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes administrative and procedural requirements for the following:
      1. Salvaging non-hazardous demolition and construction waste
      2. Recycling non-hazardous demolition and construction waste
      3. Disposing of non-hazardous demolition and construction waste

1.3 DEFINITIONS
   A. Construction Waste: Building and site improvement materials and other solid waste resulting from
      construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
   B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition
      operations.
   C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or
      deposit in landfill or incinerator acceptable to authorities having jurisdiction.
   D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
   E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
   F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the
      Work.

1.4 PERFORMANCE REQUIREMENTS
   A. General: Achieve end-of-Project rates for salvage/recycling a minimum of seventy-five percent (75%) by
      weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in
      the use of materials in the course of the Work. Use all reasonable means to divert construction and
      demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the
      following:
      1. Demolition Waste:
         a. Concrete
         b. Concrete reinforcing steel
         c. Brick
         d. Concrete masonry units
         e. Doors and frames
         f. Door hardware
         g. Metal studs
         h. Gypsum board
         i. Acoustical tile and panels
         j. Carpet
         k. Carpet pad
         l. Plumbing fixtures
         m. Piping
         n. Mechanical equipment
         o. Refrigerants
         p. Electrical conduit
         q. Copper wiring
         r. Lighting fixtures
         s. Switchgear and panelboards
         t. Transformers
      2. Construction Waste:
         a. Site-clearing waste
         b. Masonry and CMU
         c. Lumber
         d. Wood sheet materials
         e. Wood trim
         f. Metals
         g. Carpet and pad
h. Gypsum board
i. Piping
j. Electrical conduit
k. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle one-hundred percent (100%) of the following uncontaminated packaging materials:
   1) Paper
   2) Cardboard
   3) Boxes
   4) Plastic sheet and film
   5) Polystyrene packaging
   6) Wood crates
   7) Plastic pails

1.5 ACTION SUBMITTALS
A. Waste Management Plan: Submit plan within thirty (30) days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS
A. Waste Reduction Progress Reports: Concurrent with LEED Submittal. Include the following information:
   1. Material category
   2. Generation point of waste
   3. Total quantity of waste in tons
   4. Quantity of waste salvaged, both estimated and actual in tons
   5. Quantity of waste recycled, both estimated and actual in tons
   6. Total quantity of waste recovered (salvaged plus recycled) in tons
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste
B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
D. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
E. LEED Submittal: LEED letter template for Credit MRc5, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
F. Qualification Data: For waste management coordinator refrigerant recovery technician.
G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE
A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of Projects with similar requirements.
B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section 013100, “Project Management and Coordination”. Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.
1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site clearing, and construction waste generated by the Work. Use attached form or comparable generated by Contractor. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section 015000, “Temporary Facilities and Controls” for operation, termination, and removal requirements.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section 015000, “Temporary Facilities and Controls” for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: NOT Permitted on Project site.

C. Salvaged Items for Owner’s Use: Salvage items for Owner’s use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.

5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

   a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.

4. Store components off the ground and protect from the weather.

5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures
   2. Final completion procedures
   3. Warranties
   4. Final cleaning

1.3 SUBSTANTIAL COMPLETION
A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver attic stock and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   11. Advise Owner of changeover in heat and other utilities.
   12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
   13. Complete final cleaning requirements, including touchup painting.
   14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION
A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to Division 01 Section 012900, "Payment Procedures".
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report and warranty.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and
systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. Include cost for re-inspection based on incomplete work of the Contractor.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A attached or form provide by Contractor and approved by Owner and Architect.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name
   b. Date
   c. Name of Architect
   d. Name of Contractor
   e. Page number

4. Submit list of incomplete items in the following format:
   a. PDF electronic file
   b. Three (3) paper copies of product schedule or list, unless otherwise indicated. Architect will return two (2) copies.

1.6 WARRANTIES
A. Submittal Time: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES", Project name, and name of Contractor.
4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals. Included digital copies of each warranty within appropriate division of operations and maintenance manuals.

E. After final assembly, scan entire warranty binder into PDF format and deliver to Owner. Deliver entire closeout package to owner in PDF format on a thumb drive.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.
PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
   m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
   o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
   r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
   s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section 017419, "Construction Waste Management and Disposal".

END OF SECTION
SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
1. Operation and maintenance documentation directory
2. Emergency manuals
3. Operation manuals for systems, subsystems, and equipment
4. Product maintenance manuals
5. Systems and equipment maintenance manuals

1.3 DEFINITIONS
A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS
A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
B. Format: Submit operations and maintenance manuals in the following format:
   a. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Design Professional.
      a. Name each indexed document file in composite electronic index with applicable item name.
      b. Include a complete electronically-linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.
      b. One (1) paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Design Professional will return.
C. Initial Manual Submittal: Submit draft copy of each manual to Owner and Design Professional at least thirty (30) days before commencing demonstration and training. Design Professional, Owner, and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least fifteen (15) days before commencing demonstration and training. Design Professional and Commissioning Agent will return copy with comments.
   1. Correct or modify each manual to comply with Design Professional's and Commissioning Agent's comments. Submit copies of each corrected manual within fifteen (15) days of receipt of Design Professional's and Commissioning Agent's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY
A. Organization: Include a section in the directory for each of the following:
1. List of documents
2. List of systems
3. List of equipment
4. Table of contents
B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of a system, list alphabetically in separate list.
D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
E. Identification: In the documentation directory and in each operation and maintenance manual, identify each
system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4-2008, "Preparation of Operating and Maintenance Documentation for Building Systems".

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page
2. Table of contents
3. Manual contents

B. Title Page: Include the following information:
1. Subject matter included in manual
2. Name and address of Project
3. Name and address of Owner
4. Date of submittal
5. Name and contact information for Contractor
6. Name and contact information for Construction Manager
7. Name and contact information for Design Professional
8. Name and contact information for Commissioning Agent
9. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily-navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound, and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8½ by 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two (2) or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name and subject matter of contents. Indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8½ by 11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
2.3 EMERGENCY MANUALS
A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency
   2. Emergency instructions
   3. Emergency procedures
B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire
   2. Flood
   3. Gas leak
   4. Water leak
   5. Power failure
   6. Water outage
   7. System, subsystem, or equipment failure
   8. Chemical release or spill
C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping
   2. Shutdown instructions for each type of emergency
   3. Operating instructions for conditions outside normal operating limits
   4. Required sequences for electric or electronic systems
   5. Special operating instructions and procedures

2.4 OPERATION MANUALS
A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   2. Performance and design criteria if Contractor is delegated design responsibility.
   3. Operating standards
   4. Operating procedures
   5. Operating logs
   6. Wiring diagrams
   7. Control diagrams
   8. Piped system diagrams
   9. Precautions against improper use
   10. License requirements including inspection and renewal dates
B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name
   3. Equipment identification with serial number of each component
   4. Equipment function
   5. Operating characteristics
   6. Limiting conditions
   7. Performance curves
   8. Engineering data and tests
   9. Complete nomenclature and number of replacement parts
C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures
   2. Equipment or system break-in procedures
   3. Routine and normal operating instructions
   4. Regulation and control procedures
   5. Instructions on stopping
   6. Normal shutdown instructions
   7. Seasonal and weekend operating instructions
   8. Required sequences for electric or electronic systems
   9. Special operating instructions and procedures
D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS
A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
   1. Product name and model number
   2. Manufacturer's name
   3. Color, pattern, and texture
   4. Material and chemical composition
   5. Reordering information for specially manufactured products

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures
   2. Types of cleaning agents to be used and methods of cleaning
   3. List of cleaning agents and methods of cleaning detrimental to product
   4. Schedule for routine cleaning and maintenance
   5. Repair instructions

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly
   3. Identification and nomenclature of parts and components
   4. List of items recommended to be stocked as spare parts

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions
   2. Troubleshooting guide
   3. Precautions against improper maintenance
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions
   6. Demonstration and training video recording, if available

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.
PART 3 - EXECUTION

3.1 MANUAL PREPARATION AND DELIVERY

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Division 01 Section 017839, "Project Record Documents".

G. Comply with Division 01 Section 017700, "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

H. Include transmittal with all deliveries to Owner. Request receipt confirmation.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings
   2. Record Specifications
   3. Record Product Data
   4. Miscellaneous record submittals

1.3 DEFINITIONS
A. Geospatial Data: Data or information that identifies the geographic location of features and boundaries in relation to the Owner’s coordinate system.

1.4 CLOSEOUT SUBMITTALS
A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal: Submit one (1) paper copy and PDF electronic files of marked-up record prints and one (1) set of plots from corrected record digital data files. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal: Submit one (1) paper copy, PDF electronic files, CADD and BIM of marked-up record prints, one (1) set of record digital data files, and three (3) sets of record digital data file plots. Plot each drawing file, whether or not changes and additional information were recorded.
      c. Architect will amend record CADD files for submission to Owner at completion of project.
   B. Record Specifications: Submit one (1) paper copy and one (1) PDF copy of Project's Specifications, including addenda and contract modifications.
   C. Record Product Data: Submit one (1) paper copy, one (1) PDF copy of each submittal, and one (1) CoBIE format.
      1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
   D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one (1) paper copy of each submittal.
   E. Reports: Submit written report indicating items incorporated in Project record documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS
A. Record Prints: Maintain one (1) set of marked-up paper copies of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later
      b. Accurately record information in an acceptable drawing technique
      c. Record data as soon as possible after obtaining it
      d. Record and check the markup before enclosing concealed installations
      e. Cross-reference record prints to corresponding archive photographic documentation
   2. Content: Types of items requiring marking include, but are not limited to, the following:
a. Dimensional changes to Drawings
b. Revisions to details shown on Drawings
c. Depths of foundations below first floor
d. Locations and depths of underground utilities
e. Revisions to routing of piping and conduits
f. Revisions to electrical circuitry
g. Actual equipment locations
h. Duct size and routing
i. Locations of concealed internal utilities
j. Changes made by Change Order or Construction Change Directive
k. Changes made following Architect's written orders
l. Details not on the original Contract Drawings
m. Field records for variable and concealed conditions
n. Record information on the Work that is shown only schematically

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Format: As approved by Owner.
3. Format: Annotated PDF electronic file with comment function enabled.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to Architect through Construction Manager for resolution.
6. Incorporate geospatial data collected during construction and installation to more accurately reflect as-built conditions.

C. Newly-Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect and Construction Manager for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name
   b. Date
   c. Designation "PROJECT RECORD DRAWINGS"
   d. Name of Architect and Construction Manager
   e. Name of Contractor

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as a scanned PDF electronic file of the marked up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Specifications as a scanned PDF electronic file and CoBIE format of the marked up paper copy of Specifications.
1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit record Specifications as a scanned PDF electronic file of the marked up paper copy of Specifications.
1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one (1) copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION
SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment
   2. Training in operation and maintenance of systems, subsystems, and equipment
B. Related Sections:
   1. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections

1.3 INFORMATIONAL SUBMITTALS
A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
B. Qualification Data: For facilitator
C. Attendance Record: For each training module, submit list of participants and length of instruction time.
D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE
A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section 014000, "Quality Requirements", experienced in operation and maintenance procedures and training.
C. Pre-Instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section 013100, "Project Management and Coordination". Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION
A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Design Professional.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM
A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions
   b. Performance and design criteria if Contractor is delegated design responsibility
   c. Operating standards
   d. Regulatory requirements
   e. Equipment function
   f. Operating characteristics
   g. Limiting conditions
   h. Performance curves

2. Documentation: Review the following items in detail:
   a. Emergency manuals
   b. Operations manuals
   c. Maintenance manuals
   d. Project record documents
   e. Identification systems
   f. Warranties and bonds
   g. Maintenance service agreements and similar continuing commitments

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages
   b. Instructions on stopping
   c. Shutdown instructions for each type of emergency
   d. Operating instructions for conditions outside of normal operating limits
   e. Sequences for electric or electronic systems
   f. Special operating instructions and procedures

4. Operations: Include the following, as applicable:
   a. Startup procedures
   b. Equipment or system break-in procedures
   c. Routine and normal operating instructions
   d. Regulation and control procedures
   e. Control sequences
   f. Safety procedures
   g. Instructions on stopping
   h. Normal shutdown instructions
   i. Operating procedures for emergencies
   j. Operating procedures for system, subsystem, or equipment failure
   k. Seasonal and weekend operating instructions
   l. Required sequences for electric or electronic systems
   m. Special operating instructions and procedures

5. Adjustments: Include the following:
   a. Alignments
   b. Checking adjustments
   c. Noise and vibration adjustments
   d. Economy and efficiency adjustments

6. Troubleshooting: Include the following:
   a. Diagnostic instructions
   b. Test and inspection procedures

7. Maintenance: Include the following:
   a. Inspection procedures
   b. Types of cleaning agents to be used and methods of cleaning
   c. List of cleaning agents and methods of cleaning detrimental to product
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance
   f. Procedures for routine maintenance
   g. Instruction on use of special tools

8. Repairs: Include the following:
   a. Diagnosis instructions
   b. Repair instructions
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions
   d. Instructions for identifying parts and components
   e. Review of spare parts needed for operation and maintenance
PART 3 - EXECUTION

3.1 PREPARATION
A. Assemble educational materials necessary for instruction, including documentation and training modules. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section 017823, "Operations and Maintenance Data".
B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION
A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS
A. General: Engage a qualified individual to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.
B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
   1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
   2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
   3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
   4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
      a. Name of Contractor/Installer
      b. Business address
      c. Business phone number
      d. Point of contact
      e. E-mail address
C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
   1. Film training session(s) in segments not to exceed fifteen (15) minutes.
      a. Produce segments to present a single significant piece of equipment per segment.
      b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
      c. Where a training session on a particular piece of equipment exceeds fifteen (15) minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
   1. Furnish additional portable lighting as required.
E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
G. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.
END OF SECTION
SECTION 018113.01 - LEED DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   1. Section includes general requirements and procedures for compliance with USGBC LEED prerequisites and credits needed for Project to obtain LEED certification based on LEED-NC, Version 4.0. Other LEED prerequisites and credits needed to obtain LEED certification depend on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
   2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
   3. A copy of the LEED Project checklist is attached at the end of this Section for information only.

B. Related Sections:
   1. Section XXX, "Temporary Erosion and Sedimentation Controls"
   2. Section XXX, "Photographic Documentation"
   3. Section XXX, "Indoor Air Quality Management."
   4. Section XXX, "Construction Waste Management and Disposal."
   5. Section XXX, "General Commissioning Requirements."
   6. Divisions 03 through 32 Sections for requirements specific to the work of each of these Sections.

1.3 DEFINITIONS
   A. Bio-Based Materials: Materials that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM D 6866 and be legally harvested, as defined by the exporting and receiving country.
   B. Building Product Disclosure and Optimization (BPDO): A category of credits within the LEED Materials and Resources category that include various requirements for Environmental Product Declarations, sourcing of raw materials, and material ingredients.
   D. Chain-of-Custody (COC): A procedure that tracks a product form the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
   E. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
   F. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.
   G. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer’s product and the product’s supply chain.
   H. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
      1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
      2. Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
3. Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicated recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

I. Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.

J. GreenScreen: A Chemical Hazard Assessment used to identify chemicals of concern and safer alternatives.

K. Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.

L. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction."

M. LEED: Leadership in Energy & Environmental Design.

N. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

O. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.

P. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.

Q. REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) is a European standard for the regulation of chemical substances.

R. Recycled Content: Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost.

1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

S. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

T. ULEF: Designation from the California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM) indicating the manufacturer's product uses ultra low emitting formaldehyde resins that are below the CARB Phase 2 emissions standards.


1.4 ADMINISTRATIVE REQUIREMENTS

A. LEED Conference: Schedule and conduct a conference devoted to discussing LEED at a time convenient to Owner and Architect within 14 days prior to commencement of the work.

1. Attendees: Authorized representative of Owner, Owner's Commissioning Authority, Architect, Contractor and its superintendent. Major subcontractors and suppliers may be included at Contractor's discretion.

2. Agenda: LEED goals for project, Contractor's action plans, and discussion of targeted LEED prerequisites and credits.

3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED credits.

1.5 SUBMITTALS

A. General: Submit sustainable submittals required by each specification section and as summarized herein.

B. Sustainable submittals are to be submitted with other submittals required by each section. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated sustainable requirements.

C. Sustainable submittals shall include a LEED Submittal Form along with backup documentation in the form of cutsheets or letters from the manufacturers or suppliers supporting the sustainability claims made on the form. A copy of the form is included at the end of this section.

D. Project Materials Cost Data: Provide statement indicating total cost for building materials in Divisions 3-10, 31, and 32. Include statement indicating total cost for wood-based materials used for Project.

E. Sustainable Action Plans: Provide preliminary submittals within 14 days of date established for commencement of the Work for the following:

2. Indoor Air Quality management plan complying with Division 01 "Indoor Air Quality During Construction."

F. Sustainable Documentation Submittals:

1. Construction and Demolition Waste Management: Comply with submittal requirements of Division 01 Section "Construction Waste Management and Disposal."

2. BPDO – Environmental Product Declarations credit
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.

3. BPDO – Sourcing of Raw Materials credit
   a. Corporate Sustainability Reports
      1) Third-party verified published through one of the following frameworks:
         a) Global Reporting Initiative (GRI) Sustainability Report
         b) Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
         c) U.N. Global Compact: Communication of Progress
         d) ISO 26000: 2010 Guidance on Social Responsibility
   b. Extended Producer Responsibility
      1) Product data and certification letter from product manufacturers indicating participation in an extended producer responsibility program.
      2) Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials for each product whose manufacturer participates in an extended producer responsibility program.
      3) Include statement of material costs for each product whose manufacturer participates in an extended producer responsibility program.
   c. Bio-Based Materials
      1) Product data and certification for bio-based materials.
      2) Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials.
      3) Include statement of material costs.
   d. Certified Wood
      1) Product data and chain-of-custody certificates for products containing FSC certified wood.
      2) Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials.
      3) Include statement of material cost for each certified wood product.
   e. Materials Reuse
      1) Receipts indicating cost for salvaged and refurbished materials used for Project
      2) Statement indicating sources of reused materials.
   f. Recycled Content:
      1) Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      2) Include statement indicating costs for each product having recycled content.

4. BPDO – Material Ingredients credit
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
      1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
      2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
      3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.
c. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials for each product screened through initiatives listed in 1.5.F.4.b.
d. Include statement of material costs for each product screened through screened through initiatives listed in 1.5.F.4.b.

5. Indoor Air Quality: Comply with submittal requirements of Division 01 “Indoor Air Quality During Construction.”
6. Indoor Air Quality Prior to Occupancy:
   a. Signed statement describing the indoor air quality procedures that took place consistent with the requirements of Section XXXX, including the dates when flush-out or air quality testing was begun and completed and statement that filtration media was replaced after flush-out.
   b. Product data for filtration media used during flush-out and replaced prior to occupancy.
7. Low-Emitting Materials
   a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
      1) Paints and coatings.
      2) Adhesives and sealants.
      3) Flooring.
      4) Products containing composite wood or agrifiber products or wood glues.
      5) Ceilings, walls, thermal, and acoustical insulation
   b. Product data for wet-applied products applied on site meeting the following requirements:
      1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
      2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   c. Composite woods documented to have low formaldehyde emissions that meet the CARB ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

1.6 QUALITY ASSURANCE
   A. Sustainable Coordinator: Engage an experienced LEED-Accredited Professional to coordinate sustainable requirements. Sustainable coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
   A. Provide products and procedures necessary to obtain LEED credits required in this Section. Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION
   A. BPDO – Environmental Product Declarations
      1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) that meet one of the following disclosure criteria:
         a. Product-specific declaration of lifecycle impacts: Valued at one quarter (1/4) of a product.
         b. Industry-wide (generic) EPD: Valued at one half (1/2) of a product.
         c. Product-specific Type III EPD: Valued at one whole product.
   B. BPDO – Sourcing of Raw Materials
      1. Option 1: Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) that meet one of the following disclosure criteria:
         a. Corporate sustainability reports.
      2. Option 2: Provide products that meet at least one of the criteria below for at least 25%, by cost, of the total value of permanently installed building products in Divisions 3-10, 31, and 32:
         a. Extended producer responsibility program.
C. BPDO – Material Ingredients

1. Option 1: Provide at least 20 different permanently installed products (sourced from at least 5 different manufacturers) that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.

2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives for at least 25%, by cost, of the total value of permanently installed building products in Divisions 3-10, 31, and 32:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.3 LOW-EMITTING MATERIALS

A. Paints and Coatings

1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
   a. 0.5mg/m3 or less,
   b. Between 0.5 and 5.0 mg/m3 or,
   c. 0.5 mg/m3 or more.

2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011:

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Allowable VOC Content (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond Breaker</td>
<td>350</td>
</tr>
<tr>
<td>Clear wood finishes - Varnish</td>
<td>275</td>
</tr>
<tr>
<td>Clear wood finishes – Sanding Sealer</td>
<td>275</td>
</tr>
<tr>
<td>Clear wood finishes - Lacquer</td>
<td>275</td>
</tr>
<tr>
<td>Colorant – Architectural Coatings, excluding IM coatings</td>
<td>50</td>
</tr>
<tr>
<td>Colorant – Solvent Based IM</td>
<td>600</td>
</tr>
<tr>
<td>Colorant - Waterborne IM</td>
<td>50</td>
</tr>
<tr>
<td>Concrete – Curing compounds</td>
<td>100</td>
</tr>
<tr>
<td>Concrete – Curing compounds for roadways &amp; bridges</td>
<td>350</td>
</tr>
<tr>
<td>Concrete surface retarder</td>
<td>50</td>
</tr>
<tr>
<td>Driveway Sealer</td>
<td>50</td>
</tr>
<tr>
<td>Dry-fog coatings</td>
<td>50</td>
</tr>
<tr>
<td>Faux finishing coatings - Clear topcoat</td>
<td>100</td>
</tr>
<tr>
<td>Faux finishing coatings – Decorative Coatings</td>
<td>350</td>
</tr>
<tr>
<td>Faux finishing coatings - Glazes</td>
<td>350</td>
</tr>
<tr>
<td>Faux finishing coatings - Japan</td>
<td>350</td>
</tr>
<tr>
<td>Faux finishing coatings – Trowel applied coatings</td>
<td>50</td>
</tr>
<tr>
<td>Fire-proof coatings</td>
<td>150</td>
</tr>
<tr>
<td>Flats</td>
<td>50</td>
</tr>
<tr>
<td>Floor coatings</td>
<td>50</td>
</tr>
<tr>
<td>Form release compounds</td>
<td>100</td>
</tr>
<tr>
<td>Graphic arts (sign) coatings</td>
<td>150</td>
</tr>
<tr>
<td>Industrial maintenance coatings</td>
<td>100</td>
</tr>
<tr>
<td>Industrial maintenance coatings – High temperature IM coatings</td>
<td>420</td>
</tr>
<tr>
<td>Coating Type</td>
<td>Quantity</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Industrial maintenance coatings – Non-sacrificial anti-graffiti coatings</td>
<td>100</td>
</tr>
<tr>
<td>Industrial maintenance coatings – Zinc rich IM primers</td>
<td>100</td>
</tr>
<tr>
<td>Magnesite cement coatings</td>
<td>450</td>
</tr>
<tr>
<td>Mastic coatings</td>
<td>100</td>
</tr>
<tr>
<td>Metallic pigmented coatings</td>
<td>150</td>
</tr>
<tr>
<td>Multi-color coatings</td>
<td>250</td>
</tr>
<tr>
<td>Non-flat coatings</td>
<td>50</td>
</tr>
<tr>
<td>Pre-treatment wash primers</td>
<td>420</td>
</tr>
<tr>
<td>Primers, sealers and undercoaters</td>
<td>100</td>
</tr>
<tr>
<td>Reactive penetrating sealers</td>
<td>350</td>
</tr>
<tr>
<td>Recycled coatings</td>
<td>250</td>
</tr>
<tr>
<td>Roof coatings</td>
<td>50</td>
</tr>
<tr>
<td>Roof coatings, aluminum</td>
<td>100</td>
</tr>
<tr>
<td>Roof primers, bituminous</td>
<td>350</td>
</tr>
<tr>
<td>Rust preventative coatings</td>
<td>100</td>
</tr>
<tr>
<td>Stone consolidant</td>
<td>450</td>
</tr>
<tr>
<td>Sacrificial anti-graffiti coatings</td>
<td>50</td>
</tr>
<tr>
<td>Shellac– Clear</td>
<td>730</td>
</tr>
<tr>
<td>Shellac – Pigmented</td>
<td>550</td>
</tr>
<tr>
<td>Specialty primers</td>
<td>100</td>
</tr>
<tr>
<td>Stains</td>
<td>100</td>
</tr>
<tr>
<td>Stains, interior</td>
<td>250</td>
</tr>
<tr>
<td>Swimming pool coatings – repair</td>
<td>340</td>
</tr>
<tr>
<td>Swimming pool coatings – other</td>
<td>340</td>
</tr>
<tr>
<td>Traffic Coatings</td>
<td>100</td>
</tr>
<tr>
<td>Waterproofing sealers</td>
<td>100</td>
</tr>
<tr>
<td>Waterproofing concrete/masonry sealers</td>
<td>100</td>
</tr>
<tr>
<td>Wood preservatives</td>
<td>350</td>
</tr>
<tr>
<td>Low solids coatings</td>
<td>120</td>
</tr>
</tbody>
</table>

**B. Adhesives and Sealants**

1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
   a. 0.5mg/m3 or less,
   b. Between 0.5 and 5.0 mg/m3 or,
   c. 0.5 mg/m3 or more.

2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005:

<table>
<thead>
<tr>
<th>Architectural Applications</th>
<th>Allowable VOC Content (g/L):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor carpet adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Carpet pad adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Outdoor carpet adhesives</td>
<td>150</td>
</tr>
<tr>
<td>Wood flooring adhesives</td>
<td>100</td>
</tr>
<tr>
<td>Rubber floor adhesives</td>
<td>60</td>
</tr>
<tr>
<td>Subfloor adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Ceramic tile adhesives</td>
<td>65</td>
</tr>
<tr>
<td>VCT and asphalt tile adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Dry wall and panel adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Cove base adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Multipurpose construction adhesives</td>
<td>70</td>
</tr>
<tr>
<td>Structural glazing adhesives</td>
<td>100</td>
</tr>
<tr>
<td>Single ply roof membrane adhesives</td>
<td>250</td>
</tr>
</tbody>
</table>

Specialty Applications:
<table>
<thead>
<tr>
<th>Substrate Specific Applications:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal to metal substrate specific adhesives</td>
<td>30</td>
</tr>
<tr>
<td>Plastic foam substrate specific adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Porous material (except wood) substrate specific adhesives</td>
<td>50</td>
</tr>
<tr>
<td>Wood substrate specific adhesives</td>
<td>30</td>
</tr>
<tr>
<td>Fiberglass substrate specific adhesives</td>
<td>80</td>
</tr>
</tbody>
</table>

C. Flooring

1. All products installed inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
   a. 0.5mg/m3 or less,
   b. Between 0.5 and 5.0 mg/m3 or,
   c. 0.5 mg/m3 or more.

D. Composite Wood

1. Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

E. Additional Low-Emitting Requirements

1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.
2.4 INDOOR WATER USE REDUCTION
A. Indoor Water Use Reduction, Kitchen and Appliances:
   1. Provide ENERGY STAR or performance equivalent appliances.
   2. Pre-rinse spray valves are not to exceed 1.3 gpm.
   3. Kitchen equipment is to meet the following additional standards:

<table>
<thead>
<tr>
<th>Equipment type</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food steamer</td>
<td>Batch (no drain connection) ≤2 gal/hour/pan including condensate cooling water</td>
</tr>
<tr>
<td></td>
<td>Cook-to-order (with drain connection) ≤5 gal/hour/pan including condensate cooling water</td>
</tr>
<tr>
<td>Combination oven</td>
<td>Countertop or stand ≤1.5 gal/hour/pan including condensate cooling water</td>
</tr>
<tr>
<td></td>
<td>Roll-in ≤1.5 gal/hour/pan including condensate cooling water</td>
</tr>
<tr>
<td>Food waste disposer</td>
<td>Disposer 3-8 gpm full load condition, 10 minute automatic shutoff; or 1 gpm, no load condition</td>
</tr>
<tr>
<td></td>
<td>Scrap collector Maximum 2 gpm makeup water</td>
</tr>
<tr>
<td></td>
<td>Pulper Maximum 2 gpm makeup water</td>
</tr>
<tr>
<td></td>
<td>Strainer basket No additional water usage</td>
</tr>
</tbody>
</table>

B. Indoor Water Use Reduction, Plumbing Fixtures: Do not exceed water flow requirements indicated in Division 22 - PLUMBING.

2.5 LIGHTING
A. Exterior Lighting
   1. All site lighting is to meet the Backlight Uplight Glare (BUG) requirements for lighting zone 2 as defined by the IES/IDA Model Lighting Ordinance.
B. Interior Lighting
   1. Interior lighting fixtures are to meet the following requirements:
      a. Luminance of less than 2,500 cd/m² between 45 and 90 degrees from nadir (except wallwash and indirect uplighting fixtures)
      b. CRI of 80 or higher
      c. Rated life of at least 24,000 hours (or L70 for LEDs) for at least 75% of total connected lighting load.

2.6 AIR QUALITY MONITORING
A. Include CO2 monitoring of all spaces with design occupancy of ≤25 people/1,000 sf. Sensors must be between 3-6 feet above floor and have audible or visual indicator or alert the building automation system if the CO2 concentration exceeds the setpoint by more than 10%.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING
A. Environmental Tobacco Smoke Control: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
   1. Refer to Division 01 Section "Indoor Air Quality During Construction."

3.2 CONSTRUCTION WASTE MANAGEMENT
A. Comply with Division 01 Section "Construction Waste Management and Disposal."

3.3 INDOOR AIR QUALITY DURING CONSTRUCTION
A. Comply with Division 01 Section "Indoor Air Quality During Construction."

3.4 INDOOR AIR QUALITY PRIOR TO OCCUPANCY
A. Conduct either air quality testing or a building flush out consistent with the requirements of LEED credit Indoor Air Quality Assessment.
   1. Air-Quality Testing:
      a. After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline indoor-air-quality testing using testing protocols listed in Table 1 for all occupied spaces. Use current versions of ASTM standards methods, EPA
compendium methods, or ISO methods, as indicated. Laboratories that conduct the tests for chemical analysis of formaldehyde and VOCs must be accredited under ISO/IEC 17025 for the test methods they use. Demonstrate that contaminants do not exceed the concentration levels listed in Table 1.

Table 1. Maximum concentration levels, by contaminant, and testing method

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Maximum Concentration</th>
<th>ASTM and U.S. EPA methods</th>
<th>ISO method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>27 ppb</td>
<td>ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6</td>
<td>ISO 16000-3</td>
</tr>
<tr>
<td>Particulates (PM10 for all buildings; PM2.5 for buildings in EPA nonattainment areas, or local equivalent)</td>
<td>PM10: 50 micrograms per cubic meter PM2.5: 15 micrograms per cubic meter</td>
<td>EPA Compendium Method IP-10</td>
<td>ISO 7708</td>
</tr>
<tr>
<td>Ozone (for buildings in EPA nonattainment areas)</td>
<td>0.075 ppm</td>
<td>ASTM D5149-02</td>
<td>ISO 13964</td>
</tr>
<tr>
<td>Total volatile organic compounds (TVOCs)</td>
<td>500 micrograms per cubic meter</td>
<td>EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1</td>
<td>ISO 16000-6</td>
</tr>
<tr>
<td>Target chemicals listed in CDPH Standard Method 1.1, Table 4-1, except formaldehyde</td>
<td>CDPH Standard Method v1.1-2010, Allowable Concentrations, Table 4-1</td>
<td>ASTM D5197; EPA TO-1, TO-15, TO-17</td>
<td>ISO 16000-3, 16000-6</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>9 ppm; no more than 2 ppb above outdoor levels</td>
<td>EPA Compendium Method IP-3</td>
<td>ISO 4224</td>
</tr>
</tbody>
</table>

b. For each sampling point where the concentration exceeds the limit, take corrective action and retest for the noncompliant contaminants at the same sampling points. Repeat until all requirements are met.

2. Conduct an unoccupied or occupied building flush-out meeting the requirements of LEED credit Indoor Air Quality Assessment:
   a. Unoccupied flush-out shall be conducted as follows:
      1) Unoccupied flush-out shall take place after construction ends, prior to occupancy, and with all interior finishes installed.
      2) New filtration media shall be installed and a flush-out performed by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60˚ F and no higher than 80˚ F and relative humidity of no higher than 60%.
   b. Occupied flush-out shall be conducted as follows:
      1) Before the building is occupied, deliver a minimum of 3,500 cubic feet of outdoor air per square foot of floor area maintaining an internal temperature of at least 60˚ F and no higher than 80˚ F and relative humidity of no higher than 60%.
      2) Once the space is occupied, ventilate at a minimum rate that is the greater of either 0.30 cubic feet per minute per square foot of outside air or the design minimum outside air rate determined by the LEED prerequisite Minimum Indoor Air Quality Performance, whichever is greater.
      3) During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be
maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space.

END OF SECTION
SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
   B. OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY
   A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.3 DEFINITIONS
   A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
   B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
   C. CxA: Commissioning Authority.
   D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
   E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM
   A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
   B. Members Appointed by Owner:
      1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
      2. Representatives of the facility user and operation and maintenance personnel.
      3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES
   A. Provide the OPR documentation to the Design Professional, CxA and Contractor for information and use.
   B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
   C. Provide the BoD documentation, prepared by Design Professional and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES
   A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
      1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
      2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
      3. Attend commissioning team meetings held on a monthly basis.
      4. Integrate and coordinate commissioning process activities with construction schedule.
      5. Review and accept construction checklists provided by the CxA.
      6. Complete electronic construction checklists as Work is completed and provide to the CxA.
      7. Review and accept commissioning process test procedures provided by the CxA.
      8. Complete commissioning process test procedures.
1.7 CxA'S RESPONSIBILITIES
   A. Organize and lead the commissioning team
   B. Provide commissioning plan
   C. Convene commissioning team meetings
   D. Provide Project-specific construction checklists and commissioning process test procedures.
   E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
   F. Prepare and maintain the Issues Log
   G. Prepare and maintain completed construction checklist log
   H. Witness systems, assemblies, equipment, and component startup
   I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 050510 - METAL FINISHES

PART 1 - GENERAL

1.1 SUMMARY
A. Sections Includes: Metal Finishes (Drawing Designation, MF)
   1. Anodizing.
   2. Baked enamel coating.
   3. Fluorourethane coating
   4. PVDF coating.
   5. Powder coated finish.
B. Related Sections:
   1. Sections with Metals: Galvanizing.
   2. Sections with Metals: Factory or shop applied primers for field painting or coating.
   3. Section 087100 – Door Hardware: Hardware finishes.
   4. Division 9 – Finishes: Field-applied paints and coatings.

1.2 REFERENCES
A. Reference Standards: See Section 014200. In addition to requirements shown or specified, comply with applicable provisions of following:
   1. NAAMM Metal Finishes Manual for finish designations and application recommendations.

1.3 SUBMITTALS
A. General: Submit in accordance with Section 013300.
   1. Submit submittals of this section simultaneously with submittals of sections with components with finishes specified in this section.
B. Product Data: Submit following:
   1. Product data for each coating.
   2. Color charts for finish indicating manufacturer’s colors available for selection.
   3. Include sample of warranty customized for this Project.
C. Closeout Submittals: Submit following in accordance with Section 017800.
D. Sustainable Documentation Submittals:
   1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
   2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements
   3. BPDO – Sourcing of Raw Materials Credit:
      a. Recycled Content: Provide product data with recycled content information indicated as described in section 018113.01 – LEED Design Requirements.
   4. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.

PART 2 - PRODUCTS

2.1 PREPARATION
A. Sheet Steel to be Coated:
   1. Mechanical Finishes: Complete mechanical finishes of flat sheet metal surfaces before fabrication. After fabrication, finish joints, bends, abrasions, and other surface blemishes to match sheet finish. Protect mechanical finishes on exposed surfaces from damage by application of adhesive paper or other temporary protective covering, prior to shipment.
   2. Surface Preparation: Solvent-clean surfaces in compliance with SSPC-SP1 to remove dirt, oil, grease and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPC-SP5 (White Metal Blast Cleaning) or SSPC-SP8 (Pickling).
   3. Chemical Pretreatment: Apply hot phosphate surface treatment to uncoated steel sheet to comply with SSPC-PT4
   4. Comply with SSPC-PA1 “Paint Application Specification No. 1” for shop painting.
B. Protective Coatings: Do not use coatings containing lead.
   1. Primed Carbon Steel: Touch-up with primer.
   2. Galvanized Steel: Touch-up with primer.
C. Metal Patching Compound:
1. Two-part epoxy and metal filler, putty grade, composed of metal alloy blended with high molecular weight polymer.
2. Match base metal of putty to item being repaired.
3. Use steel based alloy for repairing cast iron.
4. Machinable after curing.
5. Paste consistency: Negligible slump at 1 inch thickness or less.
6. Shrinkage: Show no evidence of measurable shrinkage from plastic state to hardened state.
7. Acceptable Manufacturers and Products:
   a. Super Metal 1111, Belzona; Miami, FL. Use only on steel or cast iron items.
   b. Bondo, Bondo/Mar-Hide; Medina, OH.
   c. Accepted Substitute in accordance with Section 012500.

2.2 SUSTAINABILITY REQUIREMENTS
A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.
B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.
C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.
D. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.3 SHOP FINISHING
A. General: Apply finishes in factory after products are assembled.
B. Protect finish with factory applied protective covering prior to shipment.
   1. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.
   2. Finish accessories such as trim, flashing, screens, blank-off panels, and fasteners to match assembly.

2.4 ANODIZING
A. Anodizing: Comply with AAMA 611.
B. Clear Anodized: AA-M12C22A41, Architectural Class I, nonspecular as fabricated mechanical finish, etched medium matte, minimum 0.7 mil thick.
   1. May be architectural Class II anodic coating, AA-M12C22A31.

2.5 BAKED ENAMEL COATING
A. Baked Enamel Finish System: Includes dipped, electrostatic, powder coat, and other forms of baked enamel shop finishing.
   1. Galvanized Steel Surfaces: Cleaned and phosphate conversion coated prior to application of 0.2 mil dry film thickness rust-inhibitive prime coat.
   2. Aluminum Surfaces: Cleaned, etched and given chromate conversion pre-treatment prior to application 0.2 mil dry film thickness of prime coat.
   3. Finish Coat: Manufacturer’s standard thermo-cured acrylic, polyester or alkyd enamel, 1.0 mil minimum dry film thickness.
   4. Total Coating Dry Film Thickness: 1.5 mils.
   5. Acceptable Product: Duracron 900 by PPG.

2.6 FLUOROPOLYMER (PVDF) COATING
A. Acceptable Manufacturers:
   1. Akzo Nobel Coatings, Inc., Columbus, OH.
   2. BASF Corporation, Decatur, AL.
   3. PPG Industries Inc., Delaware, OH and Springdale, PA.
   4. Valspar Corporation, Garland, TX.
B. Fluoropolymer (PVDF) Coating: AAMA 2605.
   1. Resin: 70 percent polyvinylidene fluoride (PVDF).
   2. Substrate, Aluminum: Cleaned and chrome phosphate pre-treated.
   3. Primer: Manufacturer’s standard epoxy or acrylic coating.
      a. Dry Film Thickness: Minimum 0.20 mil.
   4. Topcoat: PVDF, Dry Film Thickness:
      a. Coil: 0.80 mil.
      b. Extrusion: 1.0 mil.
C. Fluoropolymer (PVDF) Coating with Clear Coat: AAMA 2605.
1. Resin: 70 percent polyvinylidene fluoride (PVDF).
2. Substrate, Aluminum: Cleaned and chrome phosphate pre-treated.
3. Primer: Manufacturer’s standard epoxy or acrylic coating.
   a. Dry Film Thickness: Minimum 0.20 mil.
4. Topcoat: PVDF, Dry Film Thickness:
   a. Coil: 0.80 mil.
   b. Extrusion: 1.0 mil.
5. Clear Coat: PVDF, Dry Film Thickness:
   a. Coil: 0.50 mil.
   b. Extrusion: 0.50 mil.

2.7 POWDER COATED FINISH
   1. Clean and phosphatize surfaces prior to application of coating.
   2. Apply chrome pretreatment to aluminum surfaces to receive PVDF finish.
   3. Apply powder coat finish system for sheet steel immediately following surface preparation and chemical pretreatment.
   4. Comply with paint manufacturer’s recommendations for application and baking to achieve minimum recommended dry film thickness.
B. Powder Coating with Sublimation Finish: Wood-Like finish on aluminum.
   1. Meets or exceeds AAMA 2605.
   2. Surface Preparation: Pretreat surfaces to receive coatings using applicator’s proprietary wash coat process including chemical conversion and five stage wash.
   3. Application:
      a. Apply coatings in accordance with manufacturer’s instructions to uniform surface free from blemishes.
      b. Electrostatically apply powder coating base coat to 2 to 4 mil thickness.
      c. After application polymerize coatings at 400 degrees F for 20 minutes.
      d. Completely wrap preprinted transfer film with organic photosensitive pigments and cellulose resin around components, with airtight seal.
      e. Place components on moveable trolley or large membrane frame.
      f. Remove air using vacuum suction system, bringing printed film into contact with coated surface.
      g. Place components into integrated curing oven, turning ink pigments from solid to gas and back to solid inside initial layer of powder.
      h. Remove from oven after substrate reaches designated temperature.
      i. Force air into paper to release from substrate.

2.8 STAINLESS STEEL FINISH
A. Stainless Steel Finishes: ASTM A480.
   1. Protect finishes with factory applied adhesive backed paper covering.
   2. Unless otherwise Scheduled or Indicated: No. 4 - General Purpose Polished, vertical grain.

2.9 MASTER SCHEDULE COLOR OR FINISHES
1. Color: For all color or finishes, refer to Architect’s Master Schedule.
SECTION 054000 - COLD-FORMED METAL 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. Ceiling joist framing.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of cold-formed steel framing product and accessory.
      B. Shop Drawings:
         1. Provide shop drawings prepared by cold-formed metal framing manufacturer.
         2. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
         3. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   A. Sustainable Documentation Submittals:
      1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
      2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements.
      3. BPDO – Sourcing of Raw Materials Credit:
         a. Recycled Content: Provide product data with recycled content information indicated as described in section 018113.01 – LEED Design Requirements.
      4. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.
   B. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS
   A. Evaluation Reports: For cold-formed steel framing.
      B. Metal stud manufacturer to have a third party evaluation report for its products that are reviewed to the local building code or its model code (IBC 2015 and AISI S100).

1.6 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.
      1. Products to be certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.
   B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including Base-Steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
   C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA), or be a part of a similar organization that provides verifiable code compliance program.
   D. Comply with AISI Specifications and Standards.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI’s “Code of Standard Practice”..
PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.

B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.

C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.

D. BPDO – Sourcing of Raw Materials Credit:
   1. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 30 percent.

E. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CEMCO Steel Framing Systems
   2. ClarkDietrich Building Systems
   3. MarinoWARE
   4. Mill Steel Framing
   5. Steel Network, Inc. (The).

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstand design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/4 inch or as otherwise indicated on the structural drawings.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards: Unless more stringent requirements are indicated, the following shall comply with AISI S100 and AISI S240.
   1. Floor and Roof Systems.
   2. Wall Studds.
   3. Headers.
   4. Lateral Design.

D. 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.

2.4 COLD-FORMED STEELFRAMING, GENERAL

A. Framing Members, General: Comply with AISI S200 and ASTM C 955 for conditions indicated.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance
      a. Coating: Non Coastal Areas: CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90)
C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 (Z180)

2.5 CEILING JOIST FRAMING
A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
   1. Minimum Base-Steel Thickness: 0.0538 inch.
   2. Flange Width: 2 inches, minimum.

2.6 SOFFIT FRAMING
A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Steel Thickness: 0.0538 inch 0.0966 inch.
   2. Flange Width: 2 inches, minimum.

2.7 FRAMING ACCESSORIES
A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
      a. Product: ClarkDietrich Building Systems; Spazzer 5400 Bridging Bar (SPZS) Spazzer Bar Guard (SPBG), or comparable products
   3. Web stiffeners.
      a. Product: ClarkDietrich Building Systems; QTWS, or comparable product
   4. Anchor clips.
      a. Product: ClarkDietrich Building Systems; Moment Clip (MC Series) Holdown (CD Series), or comparable products
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   9. Joist hangers and end closures.

2.8 ANCHORS, CLIPS, AND FASTENERS
A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by mechanically deposition according to ASTM B 695, Class 50.
C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS
A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
B. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
C. 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.

2.10 FABRICATION
A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Before sprayed fire-resistant materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistant materials.
B. After applying sprayed fire-resistant materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistant materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistant materials from damage.
C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
D. 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.

3.3 INSTALLATION, GENERAL
A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
B. Install cold-formed steel framing according to ASTM C 1007 and AISI S240 "North American Standard for Cold-Formed Steel Structural Framing," and to manufacturer's written instructions unless more stringent requirements are indicated.
C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 FIELD QUALITY CONTROL
   A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
   B. Field and shop welds will be subject to testing and inspecting.
   C. Testing agency will report test results promptly and in writing to Contractor and Architect.
   D. Remove and replace work where test results indicate that it does not comply with specified requirements.
   E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION
   A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
   B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000
SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
B. Products furnished, but not installed, under this Section include the following:
1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.

1.3 COORDINATION
A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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 Project site in time for installation.

1.4 ACTION SUBMITTALS
A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
B. Sustainable Documentation Submittals:
1. Recycled Content:
   a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
   b. Include Statement indicating costs for each product having recycled content.
2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
4. BPDO – Environmental Product Declarations:
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.
5. BPDO – Material Ingredients:
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 FIELD CONDITIONS
A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 “Quality Requirements,” to design ladders alternating tread devices.
B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS
A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
B. Recycled Content:
   1. Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 30 percent.
C. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD
D. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Crade certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.
E. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
F. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated.
   2. Material: Galvanized steel, ASTM A 653/A 653M, for exposed, unconditioned or corrosive environment areas.
   3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, for normal interior conditions
L. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy [Group 1] [Group 2].

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat specified in Section 099000

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS
A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
D. Galvanize miscellaneous framing and supports where indicated.
E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES
A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
B. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM
A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
C. Galvanize interior miscellaneous steel trim.
D. Prime in accordance with requirements of Section 099000.

2.9 FINISHES, GENERAL
A. Finish metal fabrications after assembly.
B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES
A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer zinc-rich primer is primer as indicated in Section 099000
   2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL
A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS
A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for ceiling hung toilet partitions overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

3.3 ADJUSTING AND CLEANING
A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099000.
SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

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. Rooftop equipment bases and support curbs.
   2. Wood blocking, cants, and nailers.
   3. Plywood backing panels.

1.3 DEFINITIONS
A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   3. NLGA: National Lumber Grades Authority.
   5. WCLIB: West Coast Lumber Inspection Bureau.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS
A. Sustainable Documentation Submittals:
   1. Certified Wood:
      1) Product data and chain-of-custody certificates for products containing FSC certified wood.
      2) Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials.
      3) Include statement of material cost for each certified wood product. Provide invoices for all permanently installed wood on the project, whether FSC-Certified or not. Invoices must indicate product name, product manufacturer, product cost, FSC status and Chain-of-Custody number for vendor.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. BPDO – Environmental Product Declarations
      a. Product-specific declarations of lifecycle impacts
b. Industry-wide (generic) Type III EPD

c. Product-specific Type III EPD.

5. BPDO – Material Ingredients

a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
   1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
   2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
   3) Cradle to Cradle v2 Basic level or v3 Bronze level
   4) Declare product labels.

b. Products that have undergone chemical inventory and screening through the following initiatives:
   1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
   2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
   3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

6. Low-Emitting Materials

a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
   1) Paints and coatings.
   2) Adhesives and sealants.
   3) Flooring.
   4) Products containing composite wood or agrifiber products or wood glues.
   5) Ceilings, walls, thermal, and acoustical insulation

b. Composite woods documented to have low formaldehyde emissions that meet the CARB ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

B. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
5. Expansion anchors.
6. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. FM Global: For wood blocking or nailers at roof conditions, comply with the requirements of FM Global Bulletin 1-49 for fastening these elements to the building, including the methodology, gauges, thicknesses, and frequency of attachment.

B. Do not use material that is warped or that does not comply with requirements for untreated material.
C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

D. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

E. Certified Wood:
   a. A minimum of 50% of permanently installed wood, calculated by cost, shall be obtained from forests certified by an FSC accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD

G. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

H. Composite Wood
   1. Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

I. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS
A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying 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.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less 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.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. 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.
   3. 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.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.
   1. Concealed blocking.
   2. Roof framing and blocking.
   3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
   4. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
   1. Mixed southern pine; SPIB.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.
2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood. Indicate that bolts and nuts are to be recessed flush with surface, unless otherwise indicated.

B. Sheathing boards are to be installed flush and plumb with the joints between the boards not to exceed 1/8-inch. Wherever possible, the finished edge is to face the perimeter of rough openings (exposed gypsum is not a suitable substrate for the air barrier's self-adhered membrane).

C. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Where wood-preservative-treated lumber is installed adjacent to metal framing, install continuous flexible flashing separator between wood and metal framing.

E. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

F. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

G. Do not splice structural members between supports unless otherwise indicated.

H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
   3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
   4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

J. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.
L. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

M. Use steel common nails unless otherwise indicated. 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 between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION
   A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
   B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION
   A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
   B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053
SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
B. C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
4. Apply AWI Quality Certification Program label to Shop Drawings.
D. Samples for Initial Selection:
1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.
E. Samples for Verification:
1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS
A. Sustainable Documentation Submittals:
1. Recycled Content:
a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
4. Certified Wood:
a. Product data and chain-of-custody certificates for products containing FSC certified wood.
b. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials.
c. Include statement of material cost for each certified wood product. Provide invoices for all permanently installed wood on the project, whether FSC-Certified or not. Invoices must indicate product name, product manufacturer, product cost, FSC status and Chain-of-Custody number for vendor.
5. Low-Emitting Materials:
a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
1) Paints and coatings.
2) Adhesives and sealants.
3) Flooring.
4) Products containing composite wood or agrifiber products or wood glues.
5) Ceilings, walls, thermal, and acoustical insulation

b. Product data for wet-applied products applied on site meeting the following requirements:
   1) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   c. Composite woods documented to have low formaldehyde emissions that meet the CARB ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

6. BPDO – Environmental Product Declarations
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.

7. BPDO – Material Ingredients
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
      1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
      2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
      3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

B. Product Certificates: For each type of product.
   1. Composite wood and agrifiber products.
   2. Thermoset decorative panels.
   3. High-pressure decorative laminate.
   4. Glass.
   5. Adhesives.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE
   A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
   B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS
   A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
   B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
      1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
   C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
1.8 COORDINATION
A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that cabinets can be supported and installed as indicated.
B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL
A. Adhesives and Sealants
1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
   a. 0.5mg/m3 or less,
   b. Between 0.5 and 5.0 mg/m3 or,
   c. 5.0 mg/m3 or more.
2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
B. Composite Wood
1. Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board’s "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
C. Additional Low-Emitting Requirements
1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.
D. Certified Wood:
1. A minimum of 50% of permanently installed wood, calculated by cost, shall be obtained from forests certified by an FSC accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
E. BPDO – Environmental Product Declarations
1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
   a. Product-specific declaration of lifecycle impacts
   b. Industry-wide (generic) EPD
   c. Product-specific Type III EPD
F. BPDO – Material Ingredients:
1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.
2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 ARCHITECTURAL CABINET FABRICATORS
A. Fabricators: Must meet the requirements in the Qualification Assurance section of the specifications.
2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom

C. Type of Construction: Frameless

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. Core Material:
   1. Exposed casework in non-wet areas: Medium-density fiberboard, Type A
   2. Semi-exposed casework in typical areas: Thermoset Decorative Laminate
   3. All casework in semi-wet areas (restroom and breakrooms with sinks): Medium-density fiberboard, Type B
   4. All casework in wet areas (laboratories, locker rooms, laundry area and cafeteria): Medium-density fiberboard, Type C

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Abet Laminati, Inc.
      b. Formica Corporation.
      c. Lamin-Art, Inc.
      d. Panolam Industries International, Inc.
      e. Wilsonart International; Div. of Premark International, Inc.
   1. Refer to Architect’s drawings / schedules for laminate or edgebanding types for cabinetry components.

G. Grade VGS.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
   4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

D. Shelf Rests: BHMA A156.9, B04013; metal.

E. Drawer Slides: BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted full-extension type; zinc-plated steel with polymer rollers.
   2. Grade 1HD-100: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. File Drawer Slides:
      a. Integrated drawer slide and side panel, full extension, self-closing feature with 2-5/8 inches (60 mm) self-closing range, built-in drawer front adjustment and bumpers, smooth, quiet travel, white baked-on epoxy finish.
   4. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
      a. Pencil Drawer Slides:
   5. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
6. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
7. File Drawer Slides: Full extension member and file railing system.
8. For computer keyboard shelves, provide Grade 1
9. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

F. Door Locks: BHMA A156.11, E07121.
G. Drawer Locks: BHMA A156.11, E07041.
H. Door and Drawer Silencers: BHMA A156.16, L03011.
I. Hanging Rail System for Wall Cabinets:
   1. Hafele; Item No. 290.11.901 Wall and Rail and Suspension Fitting, Item No. 290.00.700 and 701.
J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
       1. Satin Stainless Steel: BHMA 630.
K. For concealed hardware, provide manufacturer’s standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS
A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
C. Adhesives: Do not use adhesives that contain urea formaldehyde.
D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
       1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION
A. Fabricate cabinets to dimensions, profiles, and details indicated.
B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION
3.1 PREPARATION
A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION
A. Grade: Install cabinets to comply with same grade as item to be installed.
B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plum to a tolerance of 1/8 inch in 96 inches.
D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing.
F. Use filler matching finish of items being installed.
G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish [toggle bolts through metal backing or metal framing behind wall finish].

3.3 ADJUSTING AND CLEANING
A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
B. Clean, lubricate, and adjust hardware.
C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116
SECTION 072600 – UNDER SLAB VAPOR BARRIER

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. Sheet materials for controlling vapor diffusion through concrete slabs-on-grade.

1.3 SUBMITTALS
   A. Written certification from the manufacturer that the materials and their application as noted in this Specification and on the Drawings is appropriate and approved for this project.
   B. Product Data: Manufacturer’s product data, specifications, and installation instructions. Include vapor barrier manufacturer’s requirements for placement, seaming and pipe book installation.
   C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
   D. Submit evidence that Installer’s existing company has minimum of 5-years continuous experience in application of specified materials.
   E. Sustainable Documentation Submittals:
      1. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      2. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      3. Low-Emitting Materials:
         a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
            1) Paints and coatings.
            2) Adhesives and sealants.
            3) Flooring.
            4) Products containing composite wood or agrifiber products or wood glues.
            5) Ceilings, walls, thermal, and acoustical insulation
         b. Product data for wet-applied products applied on site meeting the following requirements:
            1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
            2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   4. BPDO – Environmental Product Declarations
      a. Product-specific declarations of lifecycle impacts
      b. Industry-wide (generic) Type III EPD
      c. Product-specific Type III EPD.
   5. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.4 QUALITY ASSURANCE
A. Installer Qualifications: An experienced installer (applicator) who is acceptable to manufacturer, who has completed applications similar in material and extent to that required for this Project, and whose work has resulted in construction with a record of successful in-service performance.
B. Source Limitations: Vapor Barrier and components to be from one source from a single manufacturer.

1.5 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 application.
B. Store materials in a clean dry location in accordance with manufacturer’s written instructions to prevent deterioration from moisture or other detrimental effects.
C. Stack membrane on elevated wood platform to eliminate warping.
D. Protect materials during handling and application to prevent damage or contamination.

1.6 PROJECT CONDITIONS
A. Environmental Limitations: Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting materials performance. Do not apply on frozen ground.
B. Close areas to traffic during application and for time period after application recommended in writing by manufacturer.

1.7 COORDINATION
A. Coordinate placement of sheet vapor barrier with Division 03 sections.
B. Coordinate placement of sealer and hardener with Division 03 sections and with requirements of finish flooring products, including adhesives, specified in Division 09 Sections.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Paints and Coatings
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
B. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
C. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally
      added exempt compounds larger than 1% weight by mass (total exempt compounds) must be
      disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply
      with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings,
      adhesives, or sealants.

D. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD

E. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to
      demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of
      the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

F. Integrally-bonded Underslab Vapor Barrier: The membrane shall form an integral and permanent bond to
   poured concrete to prevent vapor migration at the interface of the membrane and structural concrete.
   1. Type: Polyolefin film meeting requirements of ASTM E 1745, Class A.
   2. Water Vapor Transmittance (After mandatory condition per ASTM E154 sections 8,11,12,13):
      Maximum perm rating of 0.01 as tested in accordance with ASTM E 1745 Section 7.
   3. Strength: ASTM E 1745: Class A.

G. Acceptable Products:
   1. Subject to compliance with requirements, provide one of the following:
      a. Carlisle
      b. GCP
      c. WR Meadows
   2. Basis of Design: GCP; Florprufe 120

PART 3 - EXECUTION

3.1 EXAMINATION
   A. The installer shall examine conditions of substrates and other conditions under which this work is to be
      performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of
      the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 INSTALLATION
   A. Integrally-bonded Underslab Vapor Barrier:
      1. Place, protect, and repair vapor barrier sheets according to ASTM E 1643 and manufacturer's
         written instructions.
      2. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour.
      3. Install vapor barrier without tears, voids, and holes. Lap ends and edges as recommended by
         manufacturer.
      4. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab,
         otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by
         impediments, such as dowels, waterstops, or any other site condition requiring early termination of
         the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam
         or slab itself.
      5. Seal joints, tears, holes, perimeter, and penetrations through vapor with tape in accordance with
         manufacturer's recommendations.
6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier.
7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
8. Apply membrane with the HDPE film facing the prepared substrate. Remove the release liner during application.
9. Apply succeeding sheets by overlapping the previous sheet 50-mm (2 in.) along the marked lap line. End Laps should be staggered to avoid a build up of layers.
10. Mix and apply liquid detailing compound to seal around penetrations such as drainage pipes, etc.

3.3 PROTECTION

A. Protect complete membrane from damage. Prior to pouring concrete, inspect membrane for punctures or damage and repair as required to maintain vapor barrier integrity.

END OF SECTION
SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

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. Pre-finished, pre-fabricated Architectural standing seam roof system.
2. Metal trim, accessories, fasteners, insulation, underlayment, sheathing and sealants indicated on the drawings.

1.3 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner’s insurer if applicable, metal panel Installer, metal panel manufacturer’s representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer’s written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
B. Shop Drawings:
1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.
2. D. Sustainable Documentation Submittals:
1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements
3. BPDO – Sourcing of Raw Materials Credit:
   a. Recycled Content: Provide product data with recycled content information indicated as described in section 018113.01 – LEED Design Requirements.
   b. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.
1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
C. Field quality-control reports.
D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS
A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE
A. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.
B. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.
C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof area and eave, including fascia, approximately 48 inches square by full thickness, including attachments, underlayment, and accessories.
   2. Build mockups for typical roof area only, including accessories.
      a. Size: 12 feet long by 6 feet.
      b. Each type of exposed seam and seam termination.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Retain strippable protective cove ring on metal panels during installation.
E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS
A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers’ written instructions and warranty requirements.

1.10 COORDINATION
A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY
A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.
B. Special Warranty on Panel Finishes: Manufacturer’s standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weather Tightness Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.

B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.

C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.

D. BPDO – Sourcing of Raw Materials Credit:
   1. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 30 percent.
   2. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

B. Energy Performance:
   1. Solar Reflectance:
      a. Three-year, aged solar reflectance (low slope roofs) of not less than 0.55 and emissivity of not less than 0.75
      b. Initial Solar Reflectance Index:
         1) Low Slope (2:12 or less): Not less than 82 when calculated according to ASTM E 1980.
         2) Steep Slope (Greater than 2:12): Not less than 39 when calculated according to ASTM E 1980.
   c. Three-year, aged Solar Reflectance: Provide roof panels according to one of the following when tested according to CRRC-1
      1) Low Slope (2:12 or less): Not less than 64 when calculated according to ASTM E 1980.
      2) Steep Slope (Greater than 2:12): Not less than 32 when calculated according to ASTM E 1980.

C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
   4. <insert serviceability requirements>.

D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated:
   1. Uplift Rating: UL 90.

G. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global’s “Approval Guide” for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: SH.

H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

C. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AEP Span; a BlueScope Steel company.
   b. CENTRIA Architectural Systems.
   c. Fabral
   d. MBCI; a division of NCI Building Systems, L.P.
   e. McElroy Metal, Inc.
   f. Petersen Aluminum Corporation.
   g. VICWEST.

2. Basis of Design: Refer to Architect’s Master Schedule.

3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 24 gauge [22 gauge]
   c. Color: As scheduled.

4. Clips: Manufacturer’s standard to accommodate thermal movement and wind uplift.


6. Panel Profile: Stiffening Ribs (pencil Ribs)

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
   b. GCP Applied Technologies; Grace Ice and Water Shield HT.
   c. Henry Company; Blueskin PE200 HT.
   d. Tremco; ExoAir 110 AT

B. Air/Drainage Mat: Three-dimensional entangled filament mat made of nylon, to provide drainage and ventilation cavity between underlayment and metal roof.

1. Product: Enkamat ASV
2.5 MISCELLANEOUS MATERIALS
A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
D. Panel Fasteners: Self-tapping screws designed to withstand design loads.
E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.6 FABRICATION
A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.7 FINISHES
A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
C. Steel Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
      1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
      2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
         a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
   B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
   A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION
   A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
      1. Apply over the entire roof surface.
      2. Apply over the roof area indicated below:
         a. Roof perimeter for a distance up from eaves of [24 inches] [36 inches] <Insert dimension> beyond interior wall line.
         b. Valleys, from lowest point to highest point, for a distance on each side of [18 inches] <Insert dimension>. Overlap ends of sheets not less than 6 inches.
         c. Rake edges for a distance of [18 inches] <Insert dimension>.
         d. Hips and ridges for a distance on each side of [12 inches] <Insert dimension>.
         e. Roof-to-wall intersections for a distance from wall of [18 inches] <Insert dimension>.
         f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of [18 inches] <Insert dimension>.
   B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION
   A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
      1. Shim or otherwise plumb substrates receiving metal panels.
      2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
      3. Install screw fasteners in predrilled holes.
      4. Locate and space fastenings in uniform vertical and horizontal alignment.
      5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

3. Copper Panels: Use copper, stainless-steel, or hardware-bronze fasteners.


C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.

2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

5. Watertight Installation:
   a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.

   b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.

   c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION
A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16
SECTION 078100 - APPLIED FIREPROOFING

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 sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
   1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: Framing plans, schedules, or both, indicating the following:
   1. Extent of fireproofing for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of fireproofing after application.
C. Samples: For each exposed product and for each color and texture specified, 4 inches square in size.

1.5 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.
B. Sustainable Documentation Submittals:
   1. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   2. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Low-Emitting Materials:
      a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
         1) Paints and coatings.
         2) Adhesives and sealants.
         3) Flooring.
         4) Products containing composite wood or agrifiber products or wood glues.
         5) Ceilings, walls, thermal, and acoustical insulation
      b. Product data for wet-applied products applied on site meeting the following requirements:
         1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
         2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   4. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
3) Cradle to Cradle v2 Basic level or v3 Bronze level
4) Declare product labels.
b. Products that have undergone chemical inventory and screening through the following initiatives:
   1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
   2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
   3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.
   1. Build mockup of each type of fireproofing and different substrate as shown on Drawings.
   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 FIELD CONDITIONS
A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
B. Source Limitations: Obtain fireproofing from single source.
C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.
D. Asbestos: Provide products containing no detectable asbestos.
E. Paints and Coatings
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
F. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

G. Additional Low-Emitting Requirements
1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

H. BPDO – Material Ingredients:
1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.
2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS
A. Standard Durability SFRM Interior Locations, Concealed Conditions: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
1. Products: Subject to compliance with requirements, provide the following:
   a. Grace Construction Products; Monokote MK-6 Series
   b. Carboline Company; RPM International; AD Southwest Fireproofing Type 5GP
   c. Isolatek International, Inc; Cafco 300
2. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5. Surface-Burning Characteristics: Comply with ASTM E 94; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 0.
6. Compressive Strength: Minimum 1200 lbf/sq. ft. according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10. Air Erosion: Maximum weight loss of 0.0 g/sq. ft. in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.

2.3 AUXILIARY MATERIALS
A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
   1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.
C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.
D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
B. Clean substrates of substances that could impair bond of fireproofing.
C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION
A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
1. Test and inspect as required by the IBC, 1704.10.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.
END OF SECTION 078100
SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

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. Joints in or between fire-resistance-rated constructions.
      2. Joints at exterior curtain-wall/floor intersections.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For qualified Installer.
   B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
   C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.
   D. Sustainable Documentation Submittals:
      1. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      2. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      3. Low-Emitting Materials:
         a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
            1) Paints and coatings.
            2) Adhesives and sealants.
            3) Flooring.
            4) Products containing composite wood or agrifiber products or wood glues.
            5) Ceilings, walls, thermal, and acoustical insulation
         b. Product data for wet-applied products applied on site meeting the following requirements:
            1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
            2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   4. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
         2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS
A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION
A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS
2.1 FIRE-RESISTIVE JOINT SYSTEMS
A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistant joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Grace Construction Products.
      b. Hilti, Inc.
      c. RectorSeal Corporation.
      d. Specified Technologies Inc.
      e. 3M Fire Protection Products.
      f. USG Corporation.
C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Grace Construction Products.
      b. Hilti, Inc.
      c. RectorSeal Corporation.
      d. Specified Technologies Inc.
      e. 3M Fire Protection Products.
      f. USG Corporation.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

E. Paints and Coatings
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

F. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

G. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1: ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

H. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistant joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.
B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION
A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistant joint system.
C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION
A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL
A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.
3.6 CLEANING AND PROTECTING
   A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
   B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE
   A. Where UL-classified systems are indicated, they refer to system numbers in UL’s “Fire Resistance Directory” under product Category XHBN or Category XHDG.
   B. Refer to Drawings for specific scheduled applications.

END OF SECTION 078446
SECTION 079200 - JOINT SEALANTS

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. Nonstaining silicone joint sealants.
      2. Urethane joint sealants.
      3. Mildew-resistant joint sealants.
      4. Butyl joint sealants.
      5. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
   A. Product Data: For each joint-sealant product.
   B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
   C. Joint-Sealant Schedule: Include the following information:
      1. Joint-sealant application, joint location, and designation.
      2. Joint-sealant manufacturer and product name.

1.5 INFORMATIONAL SUBMITTALS
   A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer
   B. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
      1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
      2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
   C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
   D. Field-Adhesion-Test Reports: For each sealant application tested.
   E. Sustainable Documentation Submittals:
      1. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      2. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      3. Low-Emitting Materials
         a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
            1) Paints and coatings.
            2) Adhesives and sealants.
            3) Flooring.
            4) Products containing composite wood or agrifiber products or wood glues.
            5) Ceilings, walls, thermal, and acoustical insulation
         b. Product data for wet-applied products applied on site meeting the following requirements:
            1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings,
or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.

4. BPDO – Environmental Product Declarations
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.

5. BPDO – Material Ingredients
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
      1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
      2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
      3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1. Install 10 feet of sealant in each type of joint to verify and set quality standards for materials and installation procedures, and to demonstrate aesthetic effects.
D. Sealant Log: provide sealant logs

1.7 PRECONSTRUCTION TESTING
A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with stone or masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
   1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS
A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY
A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.
B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.
C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer’s written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS
2.1 JOINT SEALANTS, GENERAL
A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
B. Paints and Coatings
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
C. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California
Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
   a. 0.5mg/m3 or less,
   b. Between 0.5 and 5.0 mg/m3 or,
   c. 5.0 mg/m3 or more.

2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

D. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

E. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD

F. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

G. Colors of Exposed Joint Sealants: Match adjacent substrates unless indicated otherwise.

2.2 NONSTAINING SILICONE JOINT SEALANTS
   A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
   B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
      1. Products: Subject to compliance with requirements, provide one of the following:
         a. Dow Corning Corporation; 795.
         b. GE Construction Sealants; SilPruf NB.
         c. Pecora Corporation; 864NST.
         d. Tremco Incorporated; Spectrem 2.
         e. Sika Corporation; Silasil WS295.

2.3 URETHANE JOINT SEALANTS
   A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
      1. Products: Subject to compliance with requirements, provide one of the following:
         a. BASF Construction Chemicals, LLC, Building Systems; Masterseal TX1.
         b. Pecora Corporation; Dynatrol I-XL.
         c. Tremco Incorporated; Dymonic.
         d. Sika Corporation; Sikaflex 2c NS.

2.4 MILDEW-RESISTANT JOINT SEALANTS
   A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
2.5 BUTYL JOINT SEALANTS  
A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.  
1. Products: Subject to compliance with requirements, provide one of the following:  
a. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS  
A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.  
1. Products: Subject to compliance with requirements, provide one of the following:  
b. Sherwin-Williams Company (The); 850A.  
c. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING  
A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.  
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:  
a. BASF Construction Chemicals, LLC, Building Systems.  
b. Construction Foam Products, a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS  
A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Weep Tubes to Weep Space Between Inner and Outer Seals on Concrete Panels: Weep and Vent Tubes: Clear plastic (PVC) UV-stable reticulated tubing, minimum ¼-inch (6.35mm) inside diameter, and of length as required to extend between exterior face of sealant and open cavity behind.

PART 3 - EXECUTION  
3.1 EXAMINATION  
A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION  
A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:  
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant
adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. 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 optimum bond with joint sealants. 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:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
   d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.

4. 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 sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 DUAL SEALANT JOINT

A. All exterior joint sealants in building envelope around openings and within panel joints to have double line of sealant.

B. At base of all panel joints, provide dual joint sealant with weep tubes for moisture drainage.

C. General Contractor to sequence dual joint sealant installation to ensure that the interior line of sealant is allowed to adequately cure prior to exterior joint sealant installation.

D. Temporary terminations are required to protect installed sealant and sealant backings from moisture contamination at the end of each work day.

3.4 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.5 FIELD QUALITY CONTROL
A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
      b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.6 CLEANING
A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION
A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.8 JOINT-SEALANT SCHEDULE
   1. Joint Locations:
      b. Joints between plant-precast architectural concrete units (concrete finish).
      c. Joints between aluminum composite panel units – wet seal.
      d. Control and expansion joints in unit masonry.
      e. Joints in dimension stone cladding.
      f. Joints in exterior insulation and finish systems.
      g. Joints between different materials listed above.
      h. Perimeter joints between materials listed above and frames of doors, windows and louvers.
      i. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
   1. Joint Locations:
a. Joints between plant-precast architectural concrete units (painted finish).
b. Joints between tilt-up concrete walls (painted finish).
c. Control and expansion joints on exposed interior surfaces of exterior walls.
d. Tile control and expansion joints.
e. Vertical joints on exposed surfaces of unit masonry, walls and partitions.
f. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer’s full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:
   a. Control joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors, windows
   c. Other joints as indicated on Drawings.

3. Joint-Sealant Color: As selected by Architect from manufacturer’s full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer’s full range of colors.

E. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:
   a. Aluminum thresholds.
   b. Sill plates.
   c. Other joints as indicated on Drawings.

3. Joint-Sealant Color: As selected by Architect from manufacturer’s full range of colors.

END OF SECTION 079200
SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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 hollow-metal work.

1.3 DEFINITIONS
A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HIMMA 803 or SDI A250.8.
B. Standard Hollow Metal Work to comply with the following Steel Door Institute Performance Standards:
   1. Hollow metal work fabricated according to ANSI/SDI A250.8 (R2008).
   3. ANSI/SDI A250.6 (R2009) - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

1.4 COORDINATION
A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

1.6 INFORMATIONAL SUBMITTALS
A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
B. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
2. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.

3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.

4. BPDO – Environmental Product Declarations
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.

5. BPDO – Material Ingredients
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
      1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
      2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
      3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.7 QUALITY ASSURANCE
   A. Source Limitations: Obtain hollow metal doors and frames from single source manufacturer.
   B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 and UL10C, embossed labels are acceptable on standard 3 sided door frames.
      1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
      2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
   C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
   D. Smoke-Control Door Assemblies: Comply with NFPA 105.
   E. Preinstallation Conference: Conduct conference at Project site to review anchor methods, electrical conduit connections and custom installation of unusual openings such as pocket frames, single rabbet double egress frames and recessed doors flush with walls.

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and project-site storage. Do not use nonvented plastic.
      1. Provide additional protection to prevent damage to factory-finished units.
   B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
   C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
      1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
      2. Any scratches or disfigurements caused in shipping or handling are promptly cleaned and touched up with a rust-inhibitive primer.
PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 35 percent.

B. BPDO – Environmental Product Declarations

1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
   a. Product-specific declaration of lifecycle impacts
   b. Industry-wide (generic) EPD
   c. Product-specific Type III EPD

C. BPDO – Material Ingredients:

1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.

2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following SDI members manufacturers:

1. Amweld International, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Pearland Industries, Houston, Texas.
6. Steelcraft; an Ingersoll-Rand company.
7. No Substitutions: Only material from an SDI member will be allowed on the Project Site unless prior approval is given in accordance with substitution request requirements per General Requirements.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.3 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.4 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.

2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:
a. Materials: steel sheet, minimum thickness of 0.053 inch.
b. Construction: Full profile and throat welded.
c. Frames for Level 2 Steel Doors: (16 gauge) - thick steel sheet.
d. Frames 48-inches and wider in opening width are required to be min. 14 gauge 0.067-inch thick steel sheet.
e. Frames for Wood Doors: (16 gauge) 0.053-inch thick steel sheet.
f. Frames for Borrowed Lights: (16 gauge) 0.053-inch thick steel sheet.
g. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
h. Knock down frames field welded are not acceptable.

2.5 EXTERIOR HOLLOW-METAL DOORS AND FRAMES
A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
      d. Edge Construction: Model 2, Seamless.
      e. Core: Manufacturer’s standard kraft-paper honeycomb, polystyrene, polyurethane, polysioyanurate, mineral-board, or vertical steel-stiffener core at manufacturer’s discretion.
         1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 0.50 Btu/h-sf-F when tested according to ASTM C 1363.
   3. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
      b. Construction: Full profile and throat welded.
      c. Frames for Level 3 Steel Doors: (14 gauge) thick steel sheet.

2.6 FRAME ANCHORS
A. Jamb Anchors:
   1. Masonry Anchors: Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the (T-strap) (or) (stirrup) (or) (wire) type. Anchors shall be not less than 16 gage steel or 0.156” diameter steel wire. Stirrup straps shall be not less than 2” X 10” in size, corrugated and/or perforated. The number of anchors provided on each jamb shall be as follows:
      a. Frames up to 60” height 2 anchors.
      b. Frames greater than 60” up to 90” 3 anchors.
      c. Frames greater than 90” up to 96” 4 anchors.
      d. Frames greater than 96” 4 anchors plus one for each 24” or fraction thereof over 96”, spaced at 24” maximum between anchors.
   2. Stud Anchors: Welded frames for installation in stud partitions shall be provided with steel anchors of suitable design, not less than 18 gage thickness, secured inside each jamb as follows:
      a. Frames up to 60” height 2 anchors.
      b. Frames greater than 60” up to 90” 4 anchors.
      c. Frames greater than 90” up to 96” 5 anchors.
      d. Frames greater than 96” 5 anchors plus one for each 24” or fraction thereof over 96”, spaced at 24” maximum between anchors.
   3. Frames to be anchored to previously placed concrete, masonry or structural steel shall be provided with anchors of suitable design and quantity as shown on approved shop drawings. Fasteners for such anchors shall be provided by others.
   4. Slip on frames shall be provided with a single adjustable tension anchor in each jamb and provision for secure attachment of each jamb base to stud runners.
B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   2. Monolithic Concrete Slabs: Floor anchors shall be provided with two holes for fasteners and shall be fastened inside jambs with at least four (4) spot welds per anchor.
3. Separate Topping Concrete Slabs: Adjustable floor anchors, providing no less than 2 in. height adjustment, shall be fastened in place with at least four (4) spot welds per anchor. Terminate bottom of frames at finish floor surface.

2.7 MATERIALS
A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION
A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
C. Hollow-Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
   4. Continuous Hinge Reinforcement: Provide continuous 12 gage strap tack welded to door edge for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware," unless door has continuous steel channel for hinge reinforcement.
   5. Electrical Raceways: Provide raceways to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 08 Section "Door Hardware." Provide sufficient number of concealed wires to accommodate electrical function of specified hardware. Wire nut connections are not acceptable.
   6. Seamless Edge: Provide seamless edge on hollow metal doors by intermittently tack welding seam, grinding smooth and finishing edge free from defects and blemishes.
D. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimension on glass side of frame.
   4. High frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 42-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
   5. Continuous Hinge Reinforcement: Provide continuous 12 gage strap tack welded to frame stop for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware."
   6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   7. Provide A60 Galvannealed coating at frames in restrooms with showers/Jacuzzi, clean areas such as surgery rooms and surgical suites, clean rooms, and soil rooms.
   8. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; included to electrical thru wire hinges, electrical raceways, door position switches,
electric strikes, jamb mount card readers, and magnet locks as noted in door hardware sets in Division 8 Door Hardware and security prints.

a. Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations for all exterior locations regardless of electrical hardware specified in Division 8 Door Hardware and security prints.

b. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.

c. Conduit to be factory installed for electric hardware preps. Frames with factory installed conduit to have weld in place anchors.

d. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 8 Door Hardware and security prints.

e. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb, coordinate with hardware supplier

f. Provide conduit for standardized plug connectors to accommodate up to (12) wires for electrified door hardware specified in hardware sets in Division 08 Section "Door Hardware" and security prints.

9. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

10. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
   1) Two anchors per jamb up to 60 inches high.
   2) Three anchors per jamb from 60 to 90 inches high.
   3) Four anchors per jamb from 90 to 120 inches high.
   4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
   1) Three anchors per jamb up to 60 inches high.
   2) Four anchors per jamb from 60 to 90 inches high.
   3) Five anchors per jamb from 90 to 96 inches high.
   4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

c. Compression Type: Not less than two anchors in each frame.

d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

11. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware."

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

12. Cut-Off (Sanitary) Stops: Where indicated on Door Schedule/Frame Type, terminate stops 4 inches above finish floor with a 45 -degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

E. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

G. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
6. Gap for butted or mitered joints in glass stop should not exceed .0625 inch.

2.9 STEEL FINISHES
A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 ACCESSORIES
A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Remove welded-in shipping spreaders installed at factory after installation of frame in wall. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION
A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with manufacturer's written instructions.
B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable stops located on secure side of opening.
      d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   5. Field Supplied Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
   6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Steel Doors:
      a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
      c. At Bottom of Door: 3/8 inch plus or minus 1/32 inch.
      d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
   3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
   2. Secure exterior removable stops with security head screws.

3.4 ADJUSTING AND CLEANING
A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
B. Remove grout and other bonding material from hollow-metal work immediately after installation.
C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113
SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors with plastic-laminate faces.
2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
B. Sustainable Documentation Submittals:
1. Recycled Content:
   a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
   b. Include statement indicating costs for each product having recycled content.
2. Certified Wood:
   1) Product data and chain-of-custody certificates for products containing FSC certified wood.
   2) Location and distance from project of material manufacturer and point of extraction, harvest, or recovery for raw materials.
   3) Include statement of material cost for each certified wood product. Provide invoices for all permanently installed wood on the project, whether FSC-Certified or not. Invoices must indicate product name, product manufacturer, product cost, FSC status and Chain-of-Custody number for vendor.
3. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
4. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
5. Low-Emitting Materials
   a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
      1) Paints and coatings.
      2) Adhesives and sealants.
      3) Flooring.
      4) Products containing composite wood or agrifiber products or wood glues.
      5) Ceilings, walls, thermal, and acoustical insulation
   b. Composite woods documented to have low formaldehyde emissions that meet the CARB ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
6. BPDO – Environmental Product Declarations
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.
7. BPDO – Material Ingredients
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
      1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
      2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
      3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of mortises and holes for hardware.
   2. Dimensions and locations of cutouts.
   3. Fire-protection ratings for fire-rated doors.

D. Samples for Initial Selection: For plastic-laminate door faces.

1.4 INFORMATIONAL SUBMITTALS
A. Sample Warranty: For special warranty.
B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE
A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons.
C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS
A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.8 WARRANTY
A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL
A. Certified Wood: A minimum of 50% of permanently installed wood, calculated by cost, shall be obtained from forests certified by an FSC accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
B. Composite Wood
   1. Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
C. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

D. BPDO – Environmental Product Declarations
1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
   a. Product-specific declaration of lifecycle impacts
   b. Industry-wide (generic) EPD
   c. Product-specific Type III EPD

E. BPDO – Material Ingredients:
1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.
2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc.
2. Ampco.
3. Eggers Industries.
4. Graham Wood Doors; an Assa Abloy Group company.
5. Marshfield Door Systems, Inc.
6. Mohawk Doors; a Masonite company.
7. VT Industries, Inc.
B. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.

2.3 FLUSH WOOD DOORS, GENERAL
A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
B. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-1 or.
2. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
3. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
4. Provide doors with cores instead of particleboard cores for doors indicated to receive exit devices.

2.4 PLASTIC-LAMINATE-FACED DOORS
A. Interior Solid-Core Doors:
1. Grade: Custom.
2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
3. Colors, Patterns, and Finishes: Refer to Architect's Master Schedule.
5. Core: Particleboard.
6. Construction:Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied.
7. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
2.5  **FABRICATION**
   A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
      1. Comply with NFPA 80 requirements for fire-rated doors.
   B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
      1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
      2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
   C. Openings: Factory cut and trim openings through doors.
      1. Light Openings: Trim openings with moldings of material and profile indicated.
      2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 “Glazing.”

2.6  **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.
   B. Factory finish doors where indicated in schedules or on Drawings as factory finished.

**PART 3 - EXECUTION**

3.1  **EXAMINATION**
   A. Examine doors and installed door frames, with Installer present, before hanging doors.
      1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
      2. Reject doors with defects.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2  **INSTALLATION**
   A. Hardware: For installation, see Division 08 Section "Door Hardware."
   B. Installation Instructions: Install doors to comply with manufacturer’s written instructions and referenced quality standard, and as indicated.
      1. Install fire-rated doors according to NFPA 80.
   C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
   D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3  **ADJUSTING**
   A. Operation: Rehang or replace doors that do not swing or operate freely.
   B. 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 081416**
SECTION 083113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
   B. Shop Drawings:
      1. Include plans, elevations, sections, details, and attachments to other work.
      2. Detail fabrication and installation of access doors and frames for each type of substrate.
   C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
   D. Sustainable Documentation Submittals:
      1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
      2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements.
      3. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS
   A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.
   B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.
   C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.
   D. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.2 PERFORMANCE REQUIREMENTS
   A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
      1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
      2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS
   A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
   B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Acudor Products, Inc.
      2. Babcock-Davis.
      3. Jensen Industries; Div. of Broan-Nutone, LLC.
7. Milcor Inc.
8. Nystrom, Inc.
C. Basis of Design: Refer to Architect’s Master Schedule.

2.4 MATERIALS
A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, [Type 304] [Type 316]. Remove tool and die marks and stretch lines or blend into finish.
D. Frame Anchors: Same type as door face.
E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION
A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.
3. Provide mounting holes in frame for attachment of masonry anchors.
D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.6 FINISHES
A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
D. Steel and Metallic-Coated-Steel Finishes:
1. Factory Prime: Apply manufacturer’s standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
E. Stainless-Steel Finishes:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Comply with manufacturer’s written instructions for installing access doors and frames.
B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING
A. Adjust doors and hardware, after installation, for proper operation.
B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.
END OF SECTION 083113
SECTION 087100 - DOOR HARDWARE

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. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.
      b. Other doors to the extent indicated.
   2. Cylinders for doors specified in other Sections.
   3. Electrified hardware.
B. Related Sections:
   1. Division 08 Section "Hollow Metal Doors and Frames" for astragals furnished as part of fire-rated labeled assemblies.
   2. Division 08 Section "Aluminum Frames" for door silencers furnished as part of frames.
   3. Division 08 Section "Flush Wood Doors" for astragals as part of fire-rated labeled assemblies.
   4. Division 08 Section "Stile and Rail Wood Doors" for astragals and integral intumescent seals furnished as part of fire-rated labeled assemblies.
   5. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except including cylinders.
   6. Division 08 Section "All-Glass Entrances and Storefronts" for entrance door hardware, except including cylinders.
   7. Division 08 Section "Automatic Entrances" for entrance door hardware, except including cylinders.
   8. Division 26 Sections for connections to electric power system and for low-voltage wiring work.
   9. Division 28 Section "Access Control" for access control devices installed at door openings and furnished as part of a security access system.
   10. Division 28 Section "Intrusion Detection" for detection devices installed at door openings and furnished as part of an intrusion detection system.
   11. Division 28 Section "Fire Detection and Alarm" for connections to building fire alarm system.
C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1.3 SUBMITTALS
A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
B. Shop Drawings: Details of electrified and access control hardware, indicating the following:
   1. System Block Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following for each unique electrified opening:
      a. Point-to-point system wiring and riser diagrams.
      b. Elevation diagram of each door.
      c. Operational description.
C. 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." Furnish submittal in accordance with 013300 Submittal Procedures.
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
      a. 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. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

1) Sequence of Operation: Include description of component functions including, but not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions.

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.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1. Upon completion of construction and building turnover, furnish two (2) complete maintenance manuals to the owner. Manuals to include the following items:

1. Approved hardware schedule, catalog cuts and keying schedule.

2. Furnish keying bitting list in paper and electronic format by registered mail directly to facility manager owner.

3. Hardware installation and adjustment instructions.

4. Manufacturer’s written warranty information.

5. Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.

F. Contractor is to reject any hardware submittal that does not meet door manufacturer’s TDI/Windstorm assembly testing requirements. If the specified hardware does not meet the manufacturer’s tested assembly requirements, then the contractor is to either augment the hardware as appropriate to meet the door manufacturer’s requirements, or is to provide a door manufacturer in which the specified hardware is tested. (OMIT IF TDI COMPLIANCE IS NOT REQUIRED)

1.4 QUALITY ASSURANCE

A. Door Hardware Installer Qualifications: An experienced and factory trained Installer who has completed both standard and electrified builders hardware and integrated access control installations 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.

B. Door Hardware Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity which is not more then a half day of travel from the jobsite and who employs a qualified Architectural Hardware Consultant or equivalent experience available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying. Supplier recognized by manufacturers to be a direct factory-authorized distributor of the specified hardware products. Supplier is required to be available for onsite meetings with two days notice regarding issues that arise with opening functions, installation, keying, on-site warehousing, trouble shooting of products, and final punch out related issues.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant (AHC) and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of aluminum, steel and wood door hardware from the same single source manufacturer and supplier, unless otherwise indicated.

1. Furnish electrified door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated. Electrified modifications or enhancements made to a source manufacturer’s product line by a secondary or third party source will not be accepted.

2. Furnish standard door hardware, electrified door hardware and access control door hardware as a single sourced package from the same qualified supplier.

3. Furnish exterior door hardware from the same manufactures as the interior door hardware, no deviations will be allowed.

E. Regulatory Requirements: Comply with provisions of the following:
1. Where indicated to comply with accessibility requirements, comply with “Americans with Disabilities Act” (ADA), “Accessibility Guidelines for Buildings and Facilities” (ADAAG), ANSI A117.1, and “Texas Accessibility Standards” (TAS) as follows:
   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
   b. Door Closers: Comply with the following maximum opening-force requirements indicated:
      1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:
   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
   b. Thresholds: Not more than 1/2 inch high.

3. Texas Department of Windstorm Requirements: If the project falls under TDI requirements all products, materials and installation systems shall be evaluated and approved by the Texas Department of Insurance, Windstorm Inspection Program, and listed in the TDI Product Evaluation Index or approved by the Windstorm Engineer as outlined below:
   a. Products, materials and installation systems not presently approved by the Texas Department of Insurance, Windstorm Inspection Program, may be considered for this project however, they must be properly submitted through the Architect for review by the Windstorm Engineer.
   b. The submittal shall be a part of the initial submittal process outlined in Section 01340 and the requirements for this portion are detailed within the Texas Department of Insurance, Windstorm Inspection website at the following location: www.tdi.state.tx.us/wind/submittal_requi.html.
   c. Products, materials and installation systems not approved by the Windstorm Engineer shall NOT be installed or utilized on this project.

4. Applicable building code, as indicated on drawings.

F. Fire-Rated Door Assemblies: Furnish door hardware for 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 (neutral pressure at 40” above sill) or UL-10C.

1. Test Pressure: Positive pressure labeling.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Shipment of door hardware as detailed in approved Door Hardware Schedule Shop Drawings to be inventoried on site and upon receipt of material is secure in lock-up room furnished with shelving for door hardware. Do not store electronic access control hardware, software or accessories at Project site without prior authorization and climate controlled facility, failure to do so will void electronic warranties.

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 permanent keys, cylinders, cores, access control credentials, electronic key software with loaded bitting and key records per cylinder, 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". Hardware Supplier must be a regional supplier to address owner questions and concerns relating to keying issues that arise as project close-out.

1.6 COORDINATION

A. Templates: Door Hardware Supplier to furnish and distribute to the parties involved for templating for doors, frames, and other work specified to be factory prepared for installing standard, electrified and access control door 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. Access Control and Electrical Connections: Door Hardware supplier with door and frame supplier and security consultant to coordinate the layout and installation of scheduled electrified door hardware with required connections to source power junction boxes, power supplies and security products.

C. Keying Conference: Door Hardware Supplier to conduct keying conference to comply with requirements in Division 1 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. Review all lock and exit device functions when reviewing keying requirements.
4. Requirements for key control system.
5. Installation of permanent keys and cylinder cores.
6. Address the requirements for delivery of keys.
7. Address keying and cylinder stamping (identification) as required by owner or owner representative.
8. Establish method of submitting electronic format of keying systems and diagram and to be produced and furnished by Hardware Supplier.

D. Pre-Installation Conference: Hardware Supplier to conduct conference at Project site attended by representatives of Door Hardware Manufacturers, Hardware Installers, Owner Representative and General Contractor to review proper hardware installation methods and the procedures for receiving and handling hardware. On site training should address a minimum installation of each piece of hardware (electrical, closers, locksets, cylinders and exit devices) by qualified Hardware Supplier and Manufacturers. At completion of installation and final walk through, furnish written certification that hardware items were applied according to conference recommendations and to finish hardware specifications.

1.7 WARRANTY
A. General Warranty: 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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of standard, electrified hardware and access control hardware that fails in materials or workmanship within specified warranty period. 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.
C. Warranty Period: Two year from date of Substantial Completion, unless otherwise indicated.
D. Special Warranty Periods:
   1. Five years for mortise locksets.
   2. Five years for exit devices.
   3. Ten years for manual door closers.
   4. One year for electromechanical door hardware.
   5. Five years for Thresholds, Door Sweeps, Gasketing, Perimeter Weatherstripping.
E. Extended Warranty: As requested by the Owner, furnish a separate optional extended warranty and maintenance contract for power assist operated openings.

1.8 MAINTENANCE SERVICE
A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools to Owner and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
B. Maintenance Service: Beginning at Substantial Completion, furnish six months' full maintenance by skilled employees of door hardware suppliers and installers. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Furnish parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE
A. General: Furnish door hardware for each door to comply with requirements in this Section and the Door Hardware Schedule at the end of Part 3.
   1. Door Hardware Sets: Furnish quantity, item, size, finish or color indicated for named products listed in Hardware Sets.
   2. Sequence of Operation: Furnish electrified and access control hardware function, sequence of operation, and interface with other building control systems indicated.
B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule 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. (Source manufacturer listed in boldface).

2.2 HINGES AND PIVOTS
A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
1. Hinges:
   a. Hager Companies (HA).
   b. McKinney Products (MC).
   c. Stanley Hardware (ST).
   d. Ives (IV)

2. Continuous Geared Hinges (Aluminum):
   a. Bommer Industries (BO).
   b. McKinney Products (MC).
   c. Pemko Manufacturing (PE).
   d. Select Hinges (SH).
   e. Stanley (ST)
   f. Ives (IV)

B. Standards: BHMA Certified products complying with the following:

C. Quantity: Furnish the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches
   2. Three Hinges: For doors with heights 61 to 90 inches
   3. Four Hinges: For doors with heights 91 to 120 inches

D. For doors with heights more than 120 inches furnish 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches

Pivot Hinges: Furnish 3/4" offset, single acting pivots with one intermediate pivot for doors less than 91 inches high and two intermediate pivots for doors between 91 inches and 121 inches in height. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high.

E. Hinge Size: Furnish the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

<table>
<thead>
<tr>
<th>Maximum Door Size (inches)</th>
<th>Hinge Height (inches)</th>
<th>Metal Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-in by 86-in by 1-3/4</td>
<td>4-1/2</td>
<td>0.134</td>
</tr>
<tr>
<td>36-in by 86-in by 1-3/4</td>
<td>5</td>
<td>0.146</td>
</tr>
<tr>
<td>&lt; 36-in by 120-in by 1-3/4</td>
<td></td>
<td>0.180</td>
</tr>
</tbody>
</table>

2.3 Hinge Weight and Base Material: Unless otherwise indicated, furnish the following:
   1. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges.
   2. Interior Doors: Heavy weight, ball bearing hinges unless Hardware Sets indicate standard weight.
      a. Standard weight hinges can be used at Mechanical, Electrical, IDF, Data, and Offices with out closers openings, regardless of specified hinge weight in hardware sets.

B. Hinge Height Clarifications: Where uneven door leafs occur, the widest door leaf in the pair determines the height and weight of the hinges on the inactive and active door leafs; to ensure equal size hinges on opening.

C. Hinge Weight Clarification: If heavy weight hinges are specified in hardware sets for interior aluminum frames then standard weight hinges can be used. If aluminum frame opening has a door 42 inches or greater then provide an additional hinge in lieu of heavy weight or 5 inch hinges.

D. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
   1. Non-removable Pins: Furnish set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
      a. Out-swinging exterior doors.
      b. Out-swinging access controlled doors.
   2. Electric Hinges: Furnish electric transfer hinges with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Furnish sufficient number of concealed wires to accommodate electric function of specified hardware.

E. Continuous-Geared Hinges (Aluminum): Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame. Fabricate hinges non-handed and to template screw locations. Continuous hinges guaranteed for the life of the opening.

F. Accessible Electrical Transfer Continuous Hinges: Furnish electric transfer continuous hinges with a 12" removable hinge modification accessible without de-mounting door from the frame and standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Furnish sufficient number of concealed wires to accommodate electric function of specified hardware.

G. Electrical Power Transfer: Furnish EPT where it is required per exit device manufactures requirements and warranty for more then 1 amp of inrush for latch retraction of exit device bolt. Furnish prep in door, frame, and continuous hinge. Furnish a secure and unobtrusive means of channeling electrical wiring from the door.
frame into the door itself by concealing internal wires for low voltage electrified door hardware. Furnish an Electrical Power Transfer fully manufactured with metal.

1. Acceptable Manufacturers:
   a. Securitron Door Controls (SN) – EL-CEPT-12/22 series
   b. Von Duprin (VO) – EPT-10 Series

H. Furnish mortar guard enclosure on frames at each electrical hinge location specified.

2.4 DOOR BOLTS
   A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
      1. Surface Bolts: Flush Bolts and Coordinators:
         a. McKinney Products (MC).
         b. Rockwood Manufacturing (RO).
         c. Trimo Manufacturing (TR).
         d. Ives (IV).
   B. Standards: Comply with the following:
      1. Surface Bolts: BHMA A156.16.
   C. Furnish mortise guard enclosure on frames at each electrical hinge location specified.

2.5 LOCKS AND LATCHES
   A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
      1. Mechanical Mortise Locks and Latches:
         b. Schlage (SC) – L9000 Series
      2. Mechanical Bored Locks and Latches:
         b. Schlage (SC) – ND Series
   B. Standards: Comply with the following:
      2. Bored Locks and Latches: BHMA A156.2.
   C. Mortise Locks: BHMA Certified Grade 1, Series 1000.
   D. Bored Locks: BHMA Certified Grade 1, Series 4000.
   E. Lock Trim: Match the following design style:
      1. Levers:
         a. Best Access System (BE) – 15H/15D
         b. Schlage (SC) – 06A/RHO
   F. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:
      2. Bored Locks: BHMA A156.2
   G. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
      1. Mortise Locks: Minimum 3/4-inch latchbolt throw, with stainless steel bolt.
      2. Bored Locks: Minimum 1/2-inch latchbolt throw, 3/4” latchbolt throw at fire rated pairs.
   H. Backset: 2-3/4 inches unless otherwise indicated.

2.6 CYLINDERS AND KEYING
   A. Furnish Patented, High, Security cylinders utilizing a unique factory code pattern that is both geographically and time zoned protected. A letter of authorization under the letterhead of the End User must accompany purchases of any products which involve patented cylinders, keys and accessories. Manufacturers of patented security cylinders to allow the ability for both security and conventional cylinders to be used
together under the same facility master or grandmaster key system. The End User is required to have the ability for on-site cylinder pinning and original key cutting.

B. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
   1. Patented Cylinders:
      b. Medeco Cylinders (ME) – X4 Patented Cylinders.
      c. Sargent Manufacturing (SA) – XC or Signature Patented Cylinders.
   2. Security Cylinders:
      a. Sargent Manufacturing (SA) - Signature Patented Cylinders.
   3. High Security Cylinders:

C. Standards: Comply with the following:
   1. Cylinders: BHMA A156.5.
   2. Key Control System: BHMA A156.5.

D. Cylinder Grade: BHMA Certified Grade 1.

E. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

F. Construction Keying: Comply with the following:
   1. Construction Master keying: Furnish temporary construction master keyed cores that are replaceable by permanent cores. Furnish construction master keys in quantity as required by project Contractor.

G. Keying System: Unless otherwise indicated, furnish for a keying system complying with the following requirements:
   1. New Grand Master Key System: Cylinders are factory keyed operated by a change key, master key, and a grand master key. Conduct keying meeting with End User to define and document keying system instructions and requirements.

H. Keys: Furnish nickel-silver keys complying with the following:
   1. Stamping: Permanently inscribe each key with a visual key control number and as directed by Owner.
   2. Quantity: Furnish the following:
      a. Cylinder Change Keys (Per Key Set): Four.
      b. Master Keys (Per Level): Five.
      c. Grand Master Keys: Two.
      d. Construction Control Keys: Two.
      e. Permanent Control Keys: Two.
      g. Extra Blank Keys: Fifty.

I. Key Registration List: Furnish keying transcript list to Owner's representative for lock cylinders.

J. Key Control System: Furnish one lockable cabinet for key control and storage for up to 150 percent capacity, type and model to be determined in the keying meeting with the owner. Furnish End User with one copy of "Key Wizard" key management software program.

2.7 STRIKES

A. Standards: Comply with the following:
   1. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Dustproof Strikes: BHMA A156.16.

B. Strikes: Furnish manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Furnish manufacturer's special strike box fabricated for aluminum framing.

2.8 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
   1. Exit Devices:
a. Sargent Manufacturing (SA) - 80 Series.
b. Stanley – Apex 2000 series
c. Von Duprin (VO) – 33A/99 Series.

2. Exit Device Trim, Pull/Lever:
a. Sargent Manufacturing (SA) – FSW/ETL
b. Stanley – Apex 2000 series
c. Von Duprin (VO) – 990/994L-06

3. Electrified Options: As indicated in hardware sets, furnish electrified exit device options including: electric latch retraction, electric dogging, outside trim control, exit alarm, delayed egress, latchbolt monitoring, lock/unlock status monitoring, touchbar monitoring and request-to-exit signaling. Unless otherwise indicated, furnish electrified exit devices standard as fail secure on lever or trim side, always free egress on push side or fail safe.
   a. If exit device requires over 1 amp of in-rush then furnish manufacturer’s power supply to comply with warranty requirements, one power supply per two door leaves. Furnish power supply with applicable relay and control boards for complete operation and integration of associated hardware with opening which may require: auto operator, card access, fire alarm, delayed egress and alarmed control boards devices.
   b. If exit devices requires over 1 amp of in-rush then furnish Electric Power Transfer (EPT), coordinate preps of door, frame and continuous hinges; unless exit device manufacture has approved listed through wire products with standardized connectors.

B. Standard: BHMA A156.3.
C. Exit Devices: BHMA Certified Grade 1.
D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
F. Surface Vertical Rod Exit Devices: Furnish and install interior surface and concealed vertical rod exit devices as Less Bottom Rod unless otherwise indicated.
H. Outside Trim: Match design for locksets and latchsets, unless otherwise indicated.
I. Through Bolt Installation: For exit devices and trim as required for fire rated wood doors. Where through bolts are used, coordinate the color of bolt on opposite of device with BHMA finish color similar to the color of door finish surface.

2.9 CLOSERS
A. Manufacturers: Subject to compliance with requirements, furnish products by one the following:
      a. LCN Door Closers (LC) – 4040XP Series with heavy duty arms.
      b. Norton Door Controls (NO) - 9500 Series with heavy duty arms.
      c. Sargent Manufacturing (SA) - 281 Series with heavy duty arms.
B. Standards: Comply with the following:
   1. Closers: BHMA A156.4.
C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Furnish non-handed, factory-sized closers adjustable to meet field conditions and requirements for opening force.
D. Closer Options: As indicated in hardware sets, furnish door closer options including: delayed action, hold open arms, extra duty parallel arms, positive stop/hold open arms, compression stop/hold open arms, special mounting brackets, spacers and drop plates. Through bolt type mounting is required as indicated in the door hardware sets. Where through bolts are used, coordinate the color of bolt on opposite of device with BHMA finish color similar to the color of door finish surface.
   1. Furnish Delayed Action (DA) feature in closers at Laboratories, Shipping and Receiving doors and where cart traffic is active.
   2. Furnish shock absorbing arm such as Spring or Rubber Cushion at exterior outswing openings.

2.10 OPERATING and PROTECTIVE TRIM UNITS
A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
   1. Metal Protective Trim Units:
      a. McKinney Products (MC).
      b. Ives (IV).
      c. Rockwood Manufacturing (RO).
      d. Trimco Manufacturing (TR).
B. Standard: Comply with BHMA A156.6.
C. Materials: Fabricate protection plates from the following:
   1. Brass/Bronze and Stainless Steel: .050 inch thick, beveled four sides (B4E) with countersunk screw holes.
D. Push-Pull Design: 1" Round with 10" Centers. Furnish 90 degree offset pulls at exterior openings.
E. Fasteners: Furnish manufacturer's designated fastener type as indicated in door hardware sets.
F. Furnish protection plates sized 2 inches less than door width (LDW) on push side and 1 inch less door width on pull side by height specified in door hardware sets.
G. Coordinate stainless steel hinges, door edges, kickplates and armor plates with less then .09375 inches between meeting edges, regardless of specified sizes in hardware sets.

2.11 STOPS AND HOLDERS
A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
   1. Stops and Holders:
      a. McKinney Products (MC).
      b. Ives (IV).
      c. Rockwood Manufacturing (RO).
      d. Trimco Manufacturing (TR).
B. Standards: Comply with the following:
   1. Stops and Bumpers: BHMA A156.16.
   2. Electromagnetic Door Holders: BHMA A156.15.
   3. Combination Overhead Holders and Stops: BHMA A156.8.
   4. Door Silencers: BHMA A156.16.
C. Stops and Bumpers: BHMA Certified Grade 1.
   1. 1560 Series.
   2. LCN (LC) – SEM7800 Series.
D. Combination Overhead Stops and Holders: Certified BHMA Grade 1.
   1. Glynn-Johnson (GJ) – 100 Concealed and 90 Surface Series
   2. Rixson Hardware (RX) – 1 Concealed and 9 Surface Series.
   3. Sargent Hardware (SA) – 600 Concealed and 500 Surface Series.
E. Provide Overhead Concealed stops at public spaces such as conference, corridors, and office spaces where wall or floor stops are not applicable condition.
F. Provide Overhead Surface stops at non-public spaces such as mechanical, electrical, storage spaces.
G. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.
   1. Where floor or wall stops are not appropriate, furnish overhead stops.
H. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame. Furnish (3) per single door and (2) per paired door frame if applied gasketing is not specified in Hardware Sets.

2.12 DOOR THRESHOLDS, WEATHERSTRIPPING AND GASKETING
A. Manufacturers: Subject to compliance with requirements, furnish products by one of the following:
   1. Door Thresholds, Weatherstripping and Gasket Seals:
      b. NGP Manufacturing (NG).
      c. Pemko Manufacturing (PE).
      d. Zero International (ZE)
B. Standard: Comply with BHMA A156.22.
C. General: Furnish continuous sound gasketing on interior doors where specified.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. Install header seal before mounting door closer arms.
   2. Meeting Stile Astragals: Fasten to meeting stiles, forming seal when doors are closed.
   3. Door Sweep: Apply to bottom of door, forming seal with threshold when door is closed.
D. Basic Sound Seal Requirement: Whether indicated on the drawings or not, furnish gasketing MCKS88BL at sound rated wall types and at the following areas for limiting of sound transmission: private toilets, corridor openings, rooms and similar sound sensitive area.

2.13 FABRICATION
A. Fasteners: Furnish door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Furnish screws according to manufacturers recognized installation standards for application intended.
   1. Furnish manufactures templated and approved stainless steel screws and fasteners for stainless steel hardware specified in the hardware sets.
B. Mounting Accessories: Furnish drop plates, filler brackets, extended length screws, through bolts, and accessories for complete mounting with door, frame, light kits, applied molding and special applications as part of the base bid with complete installation per manufactures recommendations.

1. In healthcare facilities install surface mount magnetic locks on the pull side of the doors when specified in hardware sets and located on openings in corridors. Furnish all mounting brackets with finish and beauty covers.

2.14 FINISHES

A. Standard: Comply with BHMA A156.18.
B. Furnish quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.
C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable and temporary protective covering before shipping to jobsite.
D. Finishes on locksets, latchsets, and exit devices to incorporate an FDA recognized antimicrobial coating (MicroShield) listed for use on medical and food preparation equipment that will suppress the growth and spread of a broad range of bacteria, algae, fungus, mold, and mildew.
E. Furnish clear powder coat finish at exit devices located on exterior openings such as gates and at pool exit doors.
F. BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 600: Primed for painting, over steel base metal.
2. BHMA 605: Bright brass, clear coated, over brass base metal.
3. BHMA 606: Satin brass, clear coated, over brass base metal.
4. BHMA 609: Satin brass, blackened, satin relieved, clear coated, over brass base metal.
5. BHMA 611: Bright bronze, clear coated, over bronze base metal.
6. BHMA 612: Satin bronze, clear coated, over bronze base metal.
7. BHMA 613: Dark-oxidized satin bronze, oil rubbed, over bronze base metal.
8. BHMA 618: Bright nickel plated, clear coated, over brass or bronze base metal.
9. BHMA 619: Satin nickel plated, clear coated, over brass or bronze base metal.
10. BHMA 622: Flat black coated, over brass or bronze base metal.
11. BHMA 623: Light-oxidized statuary bronze, clear coated, over bronze base metal.
12. BHMA 624: Dark-oxidized statuary bronze, clear coated, over bronze base metal.
13. BHMA 625: Bright chromium plated over nickel, over brass or bronze base metal.
14. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
15. BHMA 627: Satin aluminum, clear coated, over aluminum base metal.
17. BHMA 629: Bright stainless steel, over stainless-steel base metal.
18. BHMA 630: Satin stainless steel, over stainless-steel base metal.
19. BHMA 651: Bright chromium plated over nickel, over steel base metal.
20. BHMA 652: Satin chromium plated over nickel, over steel base metal.
21. BHMA 689: Aluminum painted, over any base metal.
22. BHMA 690: Dark bronze painted, over any base metal.
23. BHMA 691: Light bronze painted, over any base metal.
24. BHMA 717: Bright aluminum, uncoated; aluminum base metal.
25. BHMA 718: Satin aluminum, uncoated; aluminum base metal.
26. BHMA 722: Dark-oxidized bronze, oil rubbed, over architectural bronze base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, 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. Examine roughing-in for electrical source power to verify actual locations of wiring connections before electrified door hardware installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.
D. 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. Steel Doors and Frames: Comply with ANSI/DHI A115 series.
C. Electrified Openings: Furnish steel doors and frames and wood doors prepared to receive electrified hardware connections specified in Door Hardware Sets without additional modification.

3.3 INSTALLATION
A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
B. Install each door hardware item to comply with manufacturer's 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.
C. Furnish and coordinate concealed wood blocking for wall mount stops as detailed in Door Hardware Schedule.
D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL
A. The Contractor shall comply with AIA A201 1997 section 3.3.1 which reads as follows: "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, unless the contract Documents give other specific instructions concerning these matters."
B. Field Inspection: Supplier and Door Hardware Manufacturer 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.
1. Access Control System Consultant will inspect integrated electronic and access control hardware and state in report whether installed work complies with or deviates from requirements, including whether electronic and access control hardware is properly installed and performing according to system operational descriptions.
   a. Inspection: Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
   b. Pre-testing: Program and adjust the system and pretest all components, wiring, and functions to verify they conform to specified requirements. Replace malfunctioning or damaged items with new items.
   c. Acceptance Test Schedule: Schedule tests after pre-testing has been successfully completed and system has been in normal functional operation for at least 2 weeks.
   d. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

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.
1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION
A. Clean adjacent surfaces soiled by door hardware installation.
B. Clean operating items as necessary to restore proper finish. Furnish final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION
A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SETS
A. The hardware sets listed below 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.

B. Abbreviations used in hardware schedule.
   1. A/C – Access Control
   2. Dbl Cyl – Double Cylinder
   3. DT – Dummy trim
   4. HO – Hold open
   5. LDW – Less door width.
   6. NL – Night Latch
   7. OW – Opening width.
   8. PA – Parallel arm.
   10. SNB – Sex Nut and bolts
   11. TB – Through bolts
   12. TJ – Top Jamb mount
HARDWARE GROUP NO. 341 AT DOOR 145

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HARDWARE GROUP NO. 739R AT DOOR 160C

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END OF SECTION
SECTION 092216 - NON-STRUCTURAL METAL 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. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. BPDO – Environmental Product Declarations
      a. Product-specific declarations of lifecycle impacts
      b. Industry-wide (generic) Type III EPD
      c. Product-specific Type III EPD.
   5. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
         2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
         3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.4 INFORMATIONAL SUBMITTALS
A. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.5 QUALITY ASSURANCE
A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.
1.6 DELIVERY, STORAGE, AND HANDLING
A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
C. Design framing systems in accordance with American Iron and Steel Institute Publication “S220 - North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members”, except as otherwise shown or specified.

2.2 FRAMING SYSTEMS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CEMCO Steel Framing Systems
   2. Clark Dietrich
   3. MarinoWARE.
   4. Nucosteel; a Nucor Company.
B. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 35 percent.
C. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD
D. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.
E. Framing Members, General: Comply with ASTM C 645 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120) or DiamondPlus® coating; roll-formed from steel meeting mechanical and chemical requirements of ASTM A 1003 with a zinc-based coating. Galvannealed products are not acceptable.
      a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authorities having jurisdiction.
F. Studs and Runners: ASTM C 645.
   1. Steel Studs and Runners:
      a. Minimum Base-Steel Thickness: 25 gage unless indicated otherwise on Drawings or below.
      1) Interior Metal Stud/Gypsum Board Assemblies, Typical Locations: Withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/240 of partition height.
2) Interior Metal Stud/Gypsum Board Assemblies at Atriums, Lobbies, Service Corridors, Exit Corridors, Elevator Lobbies, Vertical Shafts, and walls receiving plaster veneer: Withstand lateral loading (air pressure) of 7.5 psf with deflection limit not more than L/360 of partition height.

3) Interior Metal Stud/Gypsum Board Assemblies at Locations with Ceramic Tile or Other Hard Surface Finishes: Withstand typical lateral loading (air pressure) with deflection limit not more than L/360 of partition height, minimum 20 gage studs at 16 inches on center.

4) Where wall mounted equipment, woodwork, and casework items are indicated or elsewhere as shown on Drawings, provide minimum 16 gage studs.

5) Ceilings: At ceilings using mold-mildew resistant gypsum framing to be 16 inches o.c. for 5/8 inches gypsum.

7) Refer to Division 5 for stud framing which is exposed to wind loads and for studs carrying heavy vertical loads (cement plaster, manufactured stone masonry, stone tile thicker than 3/4 inch, etc.)

b. Where partition heights exceed stud manufacturer’s recommended spans, provide one of the following:
   1) Heavier stud gage.
   2) Closer stud spacing.
   3) Deeper stud size (space permitting); As approved by Architect.
   4) Above ceiling bracing, anchored to structure above.

2. Equivalent Gauge Steel Studs and Runners:
   a. Product: ClarkDietrich Building Systems; ProSTUD 25 (25EQ) and ProTRAK 25 (25EQ), or comparable products.
   b. Minimum Base-Steel Thickness: 0.0150 inch.

3. “EQ” (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved August 2015) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement.

G. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) ClarkDietrich Building Systems; [BlazeFrame DSL] [MaxTrak] Slotted Deflection Track.

H. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Steel Thickness: 0.018 inch.

I. Backing Plate: Proprietary fire-retardant-treated wood blocking and bracing in width indicated.
   1. ClarkDietrich Building Systems: Danback Fire-Retardant Treated Wood Backing Plate D16F or D24F, or a comparable product.

J. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
   2. Depth: As indicated on Drawings.
   3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.0538-inch thick, galvanized steel.

K. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Steel Thickness: 0.018 inch.
   2. Depth: 7/8 inch.

L. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.
   2. Basis of Design: Clark Dietrich, RC Deluxe single leg resilient channel.

M. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
   1. Depth: 3/4 inch.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

N. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.2 SUSPENSION SYSTEMS
A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
      a. Type: Postinstalled, expansion anchor.
   2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
   1. Depth: 2-1/2 inches.
F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
   2. Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Steel Thickness: 0.018 inch.
   3. Equivalent Gauge Steel Studs and Runners:
      a. ClarkDietrich Building Systems; ProSTUD 25 (25EQ) and ProTRAK 25 (25 EQ), or comparable products.
      b. Minimum Base-Steel Thickness: 0.0150 inch.
      a. Minimum Base-Metal Thickness: 0.018 inch.
   5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
      a. ClarkDietrich Building Systems; RC Deluxe (RCSD) Resilient Channel
      b. Configuration: Asymmetrical.
G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. Chicago Metallic Corporation; Drywall Grid System.
      c. USG Corporation; Drywall Suspension System.

2.3 AUXILIARY MATERIALS
A. General: Provide auxiliary materials that comply with referenced installation standards.
B. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
C. Isolation Strip at Exterior Walls: Provide the following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION
A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL
A. Installation Standard: ASTM C 754.
   1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
   2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
   4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
C. Install bracing at terminations in assemblies.
D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES
A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
   2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
   3. Partitions with Security Mesh: 8 inches (203 mm) o.c., unless otherwise indicated or required to comply with span and deflection design criteria.
B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
C. Install studs so flanges within framing system point in same direction.
D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   5. Curved Partitions:
a. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:
1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:
1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS
A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.
B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216
SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.
      2. Specialty Gypsum Board
      3. Tile backing panels.
      4. Trim Accessories

1.3 ACTION SUBMITTALS
   A. Sustainable Documentation Submittals:
      1. Recycled Content:
         a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
         b. Include statement indicating costs for each product having recycled content.
      2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      4. Low-Emitting Materials
         a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
            1) Paints and coatings.
            2) Adhesives and sealants.
            3) Flooring.
            4) Products containing composite wood or agrifiber products or wood glues.
            5) Ceilings, walls, thermal, and acoustical insulation
         b. Product data for wet-applied products applied on site meeting the following requirements:
            1) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
      5. BPDO – Environmental Product Declarations
         a. Product-specific declarations of lifecycle impacts
         b. Industry-wide (generic) Type III EPD
         c. Product-specific Type III EPD.
      6. BPDO – Material Ingredients
         a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
            1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
            2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
            3) Cradle to Cradle v2 Basic level or v3 Bronze level
            4) Declare product labels.
         b. Products that have undergone chemical inventory and screening through the following initiatives:
            1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
            2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
            3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.
a. Include statement indicating costs for each product having recycled content.
B. Samples: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE
A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
      3. Simulate finished lighting conditions for review of mockups.
      4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING
A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS
A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned. At Contractor's request, Owner and Architect may consider use of Glass-Mat Interior Gypsum Board panel products without additional cost to the Owner.
C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
D. Install cavity wall insulation and interior gypsum board only after building is enclosed with exterior wall assembly as detailed in the drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 35 percent.
B. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5 mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
C. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.
D. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD

E. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

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 an independent testing agency.

G. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL
A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Gypsum.
   2. CertainTeed Corp.
   3. Georgia-Pacific Gypsum LLC.
   4. Lafarge North America Inc.
   6. PABCO Gypsum.
   7. Temple-Inland.
   8. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch.
   2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Thickness: 1/2 inch.
   2. Long Edges: Tapered.

2.4 SPECIALTY GYPSUM BOARD
A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Georgia-Pacific Gypsum LLC; DensArmour Plus.
      b. Temple-Inland; GreenGlass Interior Glass-Mat Board.
   2. Core: 5/8 inch, Type X.
   4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS
A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. C-Cure; C-Cure Board 990.
   b. CertainTeed Corp.; FiberCement.
   c. Custom Building Products; Wonderboard.
   d. James Hardie Building Products, Inc.; Hardiebacker.
   e. National Gypsum Company, Permbase Cement Board.
   f. USG Corporation; DUROCK Cement Board.
2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES
A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Basis of Design: Refer to Architect’s Master Schedule
   3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

2.7 JOINT TREATMENT MATERIALS
A. General: Comply with ASTM C 475/C 475M.
B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.
C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS
A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer’s written recommendations.
B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
D. Acoustical Joint Sealant: Manufacturer’s standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and
openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pecora Corporation; AC-20 FTR or AIS-919.
   c. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
   B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL
   A. Comply with ASTM C 840.
   B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
   C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
   D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
   E. Form control and expansion joints with space between edges of adjoining gypsum panels.
   F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
      1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
      2. Fit gypsum panels around ducts, pipes, and conduits.
      3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
   G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
   H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
   I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer’s written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD
   A. Install interior gypsum board in the following locations:
      1. Type X: Vertical surfaces unless otherwise indicated.
      2. Flexible Type: Apply in double layer at curved assemblies.
      3. Ceiling Type: Ceiling surfaces.
      4. Glass-Mat Interior Gypsum: To be used when building envelope is not completed and water and moisture may be present in building.
   B. Single-Layer Application:
      1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS
A. Cementitious Backer Units: ANSI A108.11.
B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES
A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
B. Control Joints: Install control joints at locations indicated on Drawings according to ASTM C 840 and in specific locations approved by Architect for visual effect.
   1. Wall: Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet, or 900 sq ft.
   2. Ceiling with Perimeter relief: Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 ft or 2500 sq ft.
   3. Ceiling, without perimeter relief: Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 ft.
   4. Exterior: Control joints in exterior ceilings and soffits shall be installed so that linear dimensions between control joints do not exceed 30 ft at acoustical or fire-rated walls. Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8 in. type X gypsum panel products, mineral fiber, or other tested equivalent.
C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use where indicated.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. U-Bead: Use where indicated.
D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD
A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile and where indicated on Drawings.
   3. Level 3: Beneath wall coverings.
   4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
      a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
   5. Level 5: Where indicated on Drawings.
      a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900
SECTION 093000 - TILING

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. Ceramic, porcelain tile, glazed tile
   2. Stone floor tile
   3. Waterproof membrane.
   5. Metal edge strips.

1.3 DEFINITIONS
A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
C. Module Size: Actual tile size plus joint width indicated.
D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Stone Sealer: Product Data
C. Shop Drawings:
   1. Show locations of each type of tile and tile pattern.
   2. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
D. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
E. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Stone thresholds in 6-inch lengths.
   5. Metal edge strips in 6-inch lengths.
F. Sustainable Documentation Submittals:
   1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
   2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements
   3. BPDO – Sourcing of Raw Materials Credit:
      a. Recycled Content: Provide product data with recycled content information indicated as described in section 018113.01 – LEED Design Requirements.
   4. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.
1.6 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
C. Product Certificates: For each type of product.
D. Product Test Reports: For tile-setting and grouting products.
E. Slip Resistance Testing Results: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of flooring with requirements specified for slip resistance.

1.7 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE
A. Installer Qualifications:
   1.
   2. Individual installer(s) working for installing contractor are certified through Advanced Certifications for Tile Installers (ACT) for installation of large format tile and substrate preparation, membranes, mud (mortar bed) floors, mud (mortar ) walls, shower receptors.
B. Single Source Responsibility for Stone Tile: Obtain each stone from a single source with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish material without delaying the progress of the Work.
C. Drylay Procedures for Stone Tile:
   1. Following review of stone samples and shop drawings, and after fabrication of stone but prior to stone delivery to site, construct drylay sample installations for all interior stone flooring. Each drylay sample installation shall be complete with all stone proposed to be used for the project arranged as shown on the final accepted shop drawings.
      a. The purpose of the drylay installation is to avoid the potential for on-site rejection of the installed stonework where the reason for rejection would be solely for unsatisfactory stone blending (unsatisfactory color, texture or veining selection or orientation).
   2. Drylay sample installations shall be reviewed by the Architect for acceptance of the fabricators stone blending. The Architect shall be permitted to alter the blending of the fabricated material, of like size stone units, to the Architect's satisfaction. The fabrication of new stone units will not be required.
   3. Following Architect's review of drylay sample installations submit setting drawings with each stone unit numbered on the drawing to correspond to the identification number on the back of each stone unit in the accepted drylay installation.
D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS
A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS
A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.
B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.
C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.
D. BPDO – Sourcing of Raw Materials Credit:
   1. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 35 percent.
E. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.2 MANUFACTURERS
A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
   2. Obtain waterproof membrane and crack suppressant membranes, except for sheet products, from manufacturer of setting and grouting materials.
C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
   1. Stone flooring.
   2. Waterproof membrane.
   3. Crack isolation membrane.
   4. Cementitious backer units.
   5. Metal edge strips.

2.3 PRODUCTS, GENERAL
A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.
B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation on exteriors, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.4 CERAMIC / PORCELAIN TILE
A. Acceptable Manufacturers:
   1. Daltile.
   2. Crossville Ceramics.
   3. Inteceramic.
   4. Caesar.
   5. Walker Zanger.
B. Basis of Design: As indicated in the Architect’s Master Schedule.
C. Coefficient of Friction: Tiles suitable for level interior spaces expected to be walked upon shall have a wet DCOF of 0.42 or greater when tested per the DCOF AcuTest.
D. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

2.5 STONE TILE
A. Basis of Design: Refer to Architect’s Master Schedule.
B. General: Comply with ASTM C 503, ASTM C 1527 and as follows. Stone shall be sound, durable, and free of imperfections such as spalls, cracks, starts, seams, pits, stain producing minerals, and other defects that will impair its strength, durability and appearance. All material shall be subject to culling as required to match Architect’s preselected control samples prior to acquisition and thereupon through all stages of fabrication prior to delivery. Blend stone flooring units at factory/warehouse.
C. VOC Limits: any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 018113.
D. Coefficient of Friction: Tiles suitable for level interior spaces expected to be walked upon shall have a wet DCOF of 0.42 or greater when tested per the DCOF AcuTest.
E. Provide stone products that are free of defects impairing their function for use indicated, including cracks, seams, and starts.
F. Pattern Orientation: For stone varieties with a directional pattern, provide with pattern as indicated on Drawings
G. Provide matched blocks from a single quarry for each type, specie, color and quality of stone required. Extract blocks from a single bed of quarry stratum, especially reserved for Project, unless stones from randomly selected blocks are acceptable to Architect for aesthetic effect.
H. Visual Performance Criteria: All portions of stonework shall be furnished complying with the following criteria, all as reviewed and accepted by the Architect through sample submissions, sample installations, and thereafter on-site observations:
1. Color Range: Matching Architect’s samples; uniform with no discernable variations between pieces in any contiguous area.
I. Finishing Technique:
1. Polished Finish: Uniform highly reflective mirror gloss finish with the full color and crystal structure of the stone visible through the finish. Evidence of swirl shall not be permitted.

2.6 ACOUSTIC UNDERLAYMENT
A. General: Manufacturer’s standard product.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Custom Building Products.; EasyMat
   b. Healthier Choice; Sound Solution
   c. Impacta; CeraZorb
   d. Pliteq; GenieMat RST
   e. Proflex; Sound Control
   f. Protecto; WhisperMat CS
2. Thickness or IIC Rating to meet project requirements per the Architect.

2.7 WATERPROOF MEMBRANE
A. General: Manufacturer’s standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Noble Company (The); Nobleseal TS.
   b. Schluter Systems; Kerdi
2. Nominal Thickness: 0.030 inch.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
   c. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.
   d. Texrite; Hydronite with Texrite fibermesh.
2.8 CRACK ISOLATION MEMBRANE
A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Noble Company (The); Nobleseal CIS.
   b. Schluter Systems; Ditra
C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
   c. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.
   d. Texrite; Hydro-rite with Texrite fibermesh.

2.9 MORTAR BOND COAT / SETTING MATERIALS
A. Large & Heavy Tile Mortar with Polymer (formerly Medium Bed): for large, heavy, ceramic tile and stone. Used with stone or tile units (square, rectangular, plank sizes), an ANSI A118.11; product approved by manufacturer for application thickness of 5/8 inch (16 mm).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bostik, Inc.
   b. Custom Building Products.
   c. Laticrete International, Inc.; 4XLT
   d. MAPEI Corporation; Ultraflex LFT.
   e. Texrite; Total Contact
2. Basis of Design: Texrite; Total Contact
3. Provide prepackaged, dry-mortar mix containing dry, dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Back butter all tile prior to installing tile on mortar bed.
B. Improved Modified Dry Set Mortar (Thinset-Glass Tile) in compliance with ANSI A137.2: ANSI A118.15.
Used when all the tile sides are 15 inches or smaller.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ardex Americas.
   b. Custom Building Products.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Texrite
2. Basis of Design: Texrite; Ceramicflex
3. For wall applications, provide mortar complying ability to bond to glass tile ANSI A137.2 and with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.15.
4. Color: White
C. Gauged Porcelain Tile Mortar, in compliance with ANSI A137.2: ANSI A118.15. Used for extra large gauged porcelain tile.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ardex Americas.
   b. Custom Building Products.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Texrite
2. Basis of Design: Texrite; 360 Smartflex
3. Provide prepackaged, dry-mortar mix containing dry, dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Bond Strength > 600 at 28 days.
D. Epoxy Thinset Mortar: ANSI A118.3, water cleanable; 100 percent solids epoxy thin-set mortar.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ardex Americas.
b. Custom Building Products.
c. Laticrete International, Inc.
d. MAPEI Corporation.
e. Texrite

2. Basis of Design: Texrite; Epoxyplus TS

3. Water cleanable epoxy thin-set with 2-hour cleaning time. 100% solid epoxy resins and hardeners, with non-sag additive included in unit.

4. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees C and 100 degrees C), respectively, and certified by manufacturer for intended use.

5. Color number and name: Selected by Architect.


1. Latex-Portland Cement Leveling System
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Ardex Americas.
      2) Custom Building Products.
      3) Laticrete International, Inc.
      4) MAPEI Corporation.
      5) Texrite
   b. Basis of Design: Texrite; Screed 375 System

2. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

   a. Latex Additive: Manufacturer’s standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with field-mixed Portland cement and aggregate mortar bed.

4. Large & Heavy Tile Mortar with Polymer: ANSI A118.11
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Ardex Americas.
      2) Custom Building Products.
      3) Laticrete International, Inc.
      4) MAPEI Corporation.
      5) Texrite
   b. Basis of Design: Texrite; Total Contact

2.10 GROUT MATERIALS

A. Premixed Polymer Resin Grout:
   1. Pre-mixed, high performance, flexible polymer, “ready to use”, stain resistant grout. Grout has maximum color uniformity with no cement, water or additives mixing with the grout. Grout contains acrylic flexible polymer based grout that resists bacteria, mold, fungus and stains. The flexible polymer grout will resist subtle movement, vibration, flexing and minor cracks over conventional cement based grouts. Grout not recommended for water submerged or constantly wet areas.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik, Inc.
      b. Custom Building Products.
      c. Laticrete International, Inc.
      d. MAPEI Corporation.
      e. Texrite
   3. Basis of Design: Texrite, Chromaflex

B. Water-Cleanable Epoxy Grout: ANSI A118.3
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik, Inc.
      b. Custom Building Products.
      c. Laticrete International, Inc.
      d. MAPEI Corporation.
      e. Texrite
2. Basis of Design: Texrite; EpoxyPlus
3. Water cleanable grout with 2-hour cleaning time. 100% solid epoxy resins and hardeners, with non-sag additive included in unit.

C. High Performance, Polymer-Modified, Cementitious Grout (Stone Tile): ANSI A118.7.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bostik, Inc.
   b. Custom Building Products
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Texrite.

2. Basis of Design: Texrite; Accurite CA
3. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
   a. Consistent Colored Grout: Wall / Floor Tile Consistent Color

4. Grout Sealer to be applied to grout.

D. Translucent Premix Polymer Resin Grout (Glass Tile): Pre-mixed, high performance, flexible polymer, “ready to use”, stain resistant grout.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ardex Americas.
   b. Custom Building Products
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Texrite

2. Basis of Design: Texrite; Chromaflex 380 Echo (Translucent),
3. Pre-mixed, high performance, flexible polymer, “ready to use”, stain resistant grout. Grout is translucent with no cement, water or additives mixing with the grout. Grout contains acrylic flexible polymer based grout that resists bacteria, mold, fungus and stains. The flexible polymer grout will resist subtle movement, vibration, flexing and minor cracks over conventional cement based grouts. Grout not recommended for water submerged or constantly wet areas.

2.11 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   2. Basis-of-Design Product: Schluter Systems L.P.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Colorless, stain- and slip-resistant sealer, not affecting color or physical properties of stone surfaces as recommended by grout manufacturer for application indicated.
1. Basis of Design: Laticrete Stonetech

E. Stone Floor Sealer: Colorless, stain- and slip-resistant sealer, not affecting color or physical properties of stone surfaces as recommended by stone producers for application indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bostik, Inc.
   b. Custom Building Products
   c. Hillyard, Inc.
   d. HMK Stone Care System.

2.12 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants" and that do not stain stone.
1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D.
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in stone adjoining sealed joints unless otherwise indicated.
C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with thinset large and heavy tile mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset or large and heavy tile mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA’s “Handbook for Ceramic, Glass, and Stone Tile Installation” for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series “Specifications for Installation of Ceramic Tile” that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Exterior tile floors.
   b. Tile floors in wet areas.
   c. Tile swimming pool decks.
   d. Tile floors consisting of tiles 8 by 8 inches or larger.
   e. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer’s standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   2. Quarry Tile: 3/8 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, as required. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Joint Sealant: Color to match adjacent tile grout color.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
   1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-Portland cement mortar (thinstem and large and heavy tile mortar).
   2. Do not extend waterproofing under thresholds set in latex-Portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing with elastomeric sealant.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

L. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

M. Apply sealer to cleaned stone flooring according to sealer manufacturer's written instructions.

3.4 TILE BACKING PANEL INSTALLATION
   A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-Portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION
   A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
   B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION
   A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
   B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING
   A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
   B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
      1. Remove grout residue from tile as soon as possible.
      2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION
   A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 TILE INSTALLATION SCHEDULE
A. Refer to Architect’s Tile Installation drawings.

END OF SECTION 093000
SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.
B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 DEFINITIONS
A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.

1.4 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch long Samples of each type, finish, and color.

1.6 INFORMATIONAL SUBMITTALS
A. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. BPDO – Environmental Product Declarations
      a. Product-specific declarations of lifecycle impacts
      b. Industry-wide (generic) Type III EPD
      c. Product-specific Type III EPD.
   5. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.7 CLOSEOUT SUBMITTALS
A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2 percent of quantity installed.
   4. Impact Clips: Equal to 2 percent of quantity installed.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS
A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. 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: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL
A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.
B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
C. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 30 percent.
D. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD
E. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
c. Cradle to Cradle certifications.
d. Declare product labels.

2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
a. Greenscreen.
b. Cradle to Cradle.
c. REACH.

F. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

G. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

H. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. Chicago Metallic Corporation.
   4. OWA
   5. USG Interiors, Inc.; Subsidiary of USG Corporation.
   6. Rockfon, LLC.
A. Basis-of-Design Product: Refer to Architect's Master Schedule.

2.4 METAL SUSPENSION SYSTEMS, GENERAL
A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Type: anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
      c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

2.5 METAL SUSPENSION SYSTEM
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. OWA
5. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Basis of Design: Refer to Architect’s Master Schedule.

2.6 METAL EDGE MOLDINGS AND TRIM
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. Fry Reglet Corporation.
5. Gordon, Inc.
6. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Basis of Design: Refer to Architect’s Master Schedule.

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer’s standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer’s standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

D. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer’s extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer’s designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer’s written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT
A. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
   b. USG Corporation; SHEETROCK Acoustical Sealant.
2. Acoustical Sealant for Concealed Joints:
   a. Pecora Corporation; AIS-919.

B. Acoustical Sealant: Manufacturer’s standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION
A. General: Install acoustical panel ceilings to comply with ASTM C 636, according to manufacturer’s written instructions and CISCA’s “Ceiling Systems Handbook.”
   1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
   2. Suspend ceiling hangers from building’s structural members and as follows:
      1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
      2. Splay hangers only where required and, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
      3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
      4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
      5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
      6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
      7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
      8. Do not attach hangers to steel deck tabs.
      9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
     10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
     11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   C. Secure hanging wire for floating ceiling conditions so that wire is minimum 2 foot from edge of ceiling to conceal wires. Provide necessary support system to properly support grid from hanging wire to ceiling edge.
   D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
   E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
      1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
      2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
      3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
   F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
   G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
      1. Arrange directionally patterned acoustical panels as follows:
a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.

5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113
SECTION 095426 – SUSPENDED WOOD CEILINGS

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 wood ceiling panels and exposed suspension systems for ceilings.

1.3 ACTION SUBMITTALS
A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product Data: For each type of product specified.
C. Samples: For verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the range of variations expected.
   1. 12" x 18" samples of each panel type, pattern, and color.
D. Sustainable Documentation Submittals:
   1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
   2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements.
   3. BPDO – Sourcing of Raw Materials Credit:
      a. Recycled Content: Provide product data with recycled content information indicated as described in section 018113.01 – LEED Design Requirements.
      b. Certified Wood: Provide product data indicating compliance with certified wood requirements as described in section 018113.01 – LEED Design Requirements.
   4. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Size and location of initial access modules for wood ceiling panels.
   4. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wood Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE
A. Manufacturer Qualifications: Manufacturers other than those listed in Paragraph 2.1 are required to submit for approval prior to bidding per Section One.
B. Installer Qualifications: Engage an experienced Installer, approved by wood ceiling manufacturer, who has completed panel ceilings similar in species, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Inspection: All work must pass inspection and approval of architect, as well as the local codes and regulations or authorities having jurisdiction.

D. Single-Source Responsibility for Wood Ceiling System: Obtain each type of Linear Wood Ceiling Panels from a single fabricator, with in-house Shop Drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.

E. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.

F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.8 MOCK-UP
A. Build mockup of typical ceiling area as shown on Drawings.
B. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Delivery & Unloading: Coordinate crate sizes, weights, unloading options, and delivery schedule with manufacturer prior to fabrication. Deliver wood panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other mistreatment.
B. Acclimatization: Before installing wood panels, permit them to reach room temperature and a stabilized moisture content (at least 72 hours) per AWI standards.
C. Handling: Handle Linear Wood Ceiling Panels carefully to avoid chipping edges or damaging units in any way.
D. Protection:
   1. Personnel: Follow good safety and industrial hygiene practices during handling and installing of all products and systems, with personnel to take necessary precautions and wear appropriate protective equipment as needed. Read related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issues during and subsequent to installation; architect, specifier, owner, and manufacturer will rely on contractor's performance in such regard.
   2. Existing completed work: Protect completed work above suspension system from damage during installation of suspension system components.

1.10 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. Plenums have proper ventilation, especially in high moisture areas with no excessive buildup of heat in the ceiling areas.
C. Space shall be fully enclosed with all exterior windows and doors in place, glazed, and weather-stripped. Roof is to be watertight, and all wet trades’ work is to be completed, and thoroughly dry.
D. Mechanical, electrical, and other utility services above the ceiling plane shall be completed. No materials should rest against, or wrap around, the ceiling suspension components or connecting hangers.
E. Install only when the temperature and humidity closely approximate the interior conditions that will exist when the building is occupied. Heating and cooling systems shall be operating before, during, and after installation, with the humidity of the interior spaces maintained between 25 and 55 percent, and a temperature between 60 to 90 degrees F.

1.11 WARRANTY
A. Warranties: Provide owner with a (1) year warranty for material and workmanship on all installed products.
B. 1. Manufacturers: All materials, wood ceiling and grid, shall be warranted for (1) one year for material and workmanship.
C. 2. Installer: All work shall be warranted for (1) year from final acceptance of completed work.
PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS
A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.
B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.
C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.
D. BPDO – Sourcing of Raw Materials Credit:
   1. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 35 percent.
   2. Certified Wood: Provide product that meets certified wood criteria listed in section 018113.01 – LEED Design Requirements.
E. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.2 PERFORMANCE REQUIREMENTS
A. 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: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 450 or less.
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.

2.3 LINEAR WOOD CEILING PANELS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. 9Wood
   2. Armstrong World Industries, Inc.
   3. CertainTeed Corp.
   5. USG Interiors, Inc.; Subsidiary of USG Corporation.
   6. Rockfon, LLC.
   7. Rulon International
B. Basis-of-Design: CertainTeed Corp.; Panelized Linear - Refer to Architect’s Master Schedule.

2.4 METAL SUSPENSION SYSTEMS, GENERAL
A. Metal T-Grid Suspension System: Provide standard interior Metal Heavy Duty 15/16” suspension T-Grid system using Main Runners, Cross-tees, Wall Angle or Shadow Moldings of types, structural classifications, and black finishes indicated and that comply with applicable ASTM C 635 requirements. Comply with all applicable codes and ordinances.
B. Attachment Devices: Size for 3 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
C. Wire, Braces, Ties, Hanger Rods, Flat Hangers and Angle Hangers: Provide wires, rods and hangers that comply with applicable ASTM specifications.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, including structural framing to which ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of ceilings.
B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
B. Layout: Measure each ceiling area and establish the layout of Linear Wood Ceiling Panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans in accordance with wood ceiling manufacturer’s approved Shop Drawings.

3.3 INSTALLATION
A. General: Install ceilings to comply with manufacturer’s instructions and CISCA “Ceiling Systems Handbook.”
B. Attachments: Suspend ceiling hangers from building’s structural members per manufacturer’s instructions and in compliance with all local codes and regulations.
C. Installation of Metal T-Bar Grid: Install, align, brace, tie-off, mount, handle interferences, and space suspension T-Grid in accordance with suspension manufacturer’s instructions and in compliance with all local codes and regulations.
D. Install wood ceiling panels in accordance with manufacturer’s installation instructions and in compliance with all local codes and regulations. Install with undamaged edges and fitted accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit, as required.
E. Suspension Runners: Install suspension system runners so they are square and securely interlocked with one another. Install number and use on-center spacing per wood ceiling manufacturer’s instructions, as indicated on approved Shop Drawings and in compliance with all local codes.

3.4 CLEANING
A. Clean exposed surfaces of wood ceiling panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer’s written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113
SECTION 098116 - ACOUSTICAL BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Concealed building acoustical insulation.

1.2 ACTION SUBMITTALS
A. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and
         pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or
      recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section
      018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b
      in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. Low-Emitting Materials
      a. Product data indicating VOC content and completion of emissions testing and compliance
         per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the
         following materials:
         1) Paints and coatings.
         2) Adhesives and sealants.
         3) Flooring.
         4) Products containing composite wood or agrifiber products or wood glues.
         5) Ceilings, walls, thermal, and acoostical insulation
      b. Product data for wet-applied products applied on site meeting the following requirements:
         1) Adhesives and sealants meeting the applicable chemical content requirements of
            SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   5. BPDO – Environmental Product Declarations
      a. Product-specific declarations of lifecycle impacts
      b. Industry-wide (generic) Type III EPD
      c. Product-specific Type III EPD.
   6. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following
         disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract
            Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with
            the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following
         initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm
            demonstrating no Benchmark 1 hazards.
         2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum
            certification.
         3) REACH screening demonstrating no ingredients on the REACH Authorization or
            Candidate lists.

B. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE
A. Source Limitations: Obtain each type of building insulation through one source.
B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response
   characteristics indicated, as determined by testing identical products per test method indicated below by
UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.


1.4 DELIVERY, STORAGE, AND HANDLING
A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer’s written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Glass-Fiber Insulation:
      a. CertainTeed Corporation.
      c. Owens Corning.

2.2 INSULATING MATERIALS
A. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

B. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

C. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD

D. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm): 
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

E. General: Provide insulating materials that comply with requirements and with referenced standards.
1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

F. Unfaced, Flexible Glass-Fiber Board Insulation (in walls and above ceilings): ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   2. Thickness: As indicated on the Architect's Partition Type sheet.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL
A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.
F. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION
A. Install blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.5 PROTECTION
A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 098116
SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY
   A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.
   B. Section Includes:
      1. Complete surface preparation and finishing for field application of coatings and requirements for field finishing mechanical and electrical equipment.
      2. Examine specifications for various other trades and their provisions regarding their painting. Surfaces that are left unfinished by other sections of the specifications shall be painted or finished as a part of this Section.
      3. Colors, including deep tones, will be selected by the Architect. Number of colors to be used on job will be determined by Architect.

1.2 SURFACES NOT TO RECEIVE FIELD FINISHING
   A. Do not paint copper, bronze, chrome plated items, nickel, stainless steel, Monel metal, lead, face brick, prefinished wall, ceiling, and floor coverings, items with factory applied final finish (except where exposed on roofs and in finished spaces), elevator shafts, crawl spaces, chases, and plenums above suspended ceilings unless otherwise specified or scheduled.

1.3 DEFINITIONS
   A. Conform to ASTM D16 for interpretation of terms used in this Section.

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.

1.5 REGULATORY REQUIREMENTS
   A. Conform to applicable building code for flame spread/fuel contribution/smoke development rating requirements for finishes.
   B. Comply with applicable city, county, state, and federal requirements and ordinances regarding maximum VOC (Volatile Organic Compound) content of all coatings.

1.6 TESTS
   A. Provide periodic testing with Wet Film Thickness gage to verify that proper thickness of finish coatings are being applied.

1.7 SUBMITTALS
   A. Provide product data describing physical performance criteria and composition on all finishing products.
   B. Samples, 12 by 12 inches in size illustrating range of colors and textures selected for each surface finishing product scheduled.
   C. Sustainable Documentation Submittals:
      1. Recycled Content:
         a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
         b. Include statement indicating costs for each product having recycled content.
      2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      4. Low-Emitting Materials
a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
   1) Paints and coatings.
   2) Adhesives and sealants.
   3) Flooring.
   4) Products containing composite wood or agrifiber products or wood glues.
   5) Ceilings, walls, thermal, and acoustical insulation
b. Product data for wet-applied products applied on site meeting the following requirements:
   1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
   2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.

5. BPDO – Environmental Product Declarations
   a. Product-specific declarations of lifecycle impacts
   b. Industry-wide (generic) Type III EPD
   c. Product-specific Type III EPD.

6. BPDO – Material Ingredients
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
   b. Products that have undergone chemical inventory and screening through the following initiatives:
      1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
      2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
      3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.8 MOCKUP PANELS
   A. Provide field sample panel, 96 inches long by 96 inches wide, illustrating each coating color, texture, and finish intended for use.
   B. Locate where directed.
   C. Accepted sample may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, and protect products under provisions of Division 1 section “Product Requirements”
   B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
   C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
   D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.
   E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.10 ENVIRONMENTAL REQUIREMENTS
   A. Do not apply materials when surface and ambient temperatures are outside the ranges required by paint manufacturer.
   B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
   C. Do not apply exterior coatings during rain or snow, or when relative humidity is above 75 percent, unless required otherwise by manufacturer's instructions.
   D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
E. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.11 EXTRA STOCK
A. Provide a 5 gallon container of each color to Owner.
B. Label each container with color, color number, texture, and room locations, in addition to the manufacturer's label.

1.12 SCAFFOLDS AND PROTECTION
A. Provide adequate safe ladders, scaffolds, and stages necessary to complete work.
B. Protect completed finish and paint work, and protect adjacent finish surfaces from paint splatter, spills and stains. Use adequate drop cloths and masking procedures during progress of work.

1.13 PRECAUTIONS
A. Do not store paints, oils, thinners and other flammable items inside the building and 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. Precaution shall be taken 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
   1. Behr Process Corporation (Behr)
   2. Benjamin Moore.
   3. PPG Paints
B. Materials selected for coating systems for each type surface shall be product of a single manufacturer unless otherwise specified. Secondary products such as linseed oil, turpentine and shellacs shall be first quality products of a reputable manufacturer.

2.2 MATERIALS
A. Paints and Coatings
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
B. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005.
and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

C. Additional Low-Emitting Requirements
1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

D. BPDO – Environmental Product Declarations
1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
   a. Product-specific declaration of lifecycle impacts
   b. Industry-wide (generic) EPD
   c. Product-specific Type III EPD

E. BPDO – Material Ingredients:
1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.
2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

F. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating with good flow and brushing properties; capable of drying or curing free of streaks or sags.

G. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.


2.3 FINISHES
A. Color and Sheen: As indicated on Architect’s Master Schedule.

2.4 INTERIOR PAINT SCHEDULE
A. Drywall (Gypsum):
1. Latex:
   a. PPG: 1 coat Speedhide latex sealer 6-2 primer, 2 coats Speedhide zero VOC latex
   b. Sherwin-Williams: 1 coat High Build Latex Primer B28W8601, 2 coats Sherwin-Williams ProMar 200 Zero VOC
   c. Behr: 1 coat Premium Plus Interior Drywall Primer 73; 2 coats Behr Pro i300 Interior Paint.

B. Shop Primed Ferrous Metal:
1. High Performance Coating, Water-Based Acrylic:
   a. PPG: Eggshell: 2 topcoats DEVFLEX High Performance WB Acrylic 4212 over prepared substrate.
   b. 2 topcoats Sherwin-Williams Zero VOC Acrylic Eg-Shel B66-660 Series.

C. Handrails, Stairs, and Guardrails:
1. High Performance Coating, Epoxy:
   b. Sherwin-Williams: 1 coat Waterbased Pro Industrial Pro-Cryl Primer, B73A200, 2 coats Sherwin-Williams Waterbased Tile Clad Finish B73-100 Series.
   c. Behr: 1 coat AquaGrip 5001 Waterborne Primer: 2 coats AquaGrip 2600 Gloss Water-Based Epoxy.

D. Flooring, Steps, and Catwalks:
1. High Performance Coating, Water-Based Epoxy:
   a. PPG: 3 coat Aquapong WB 98-1
b. Sherwin-Williams: 1 coat Waterbased Pro Industrial Pro-Cryl Primer, B73A200, 2 coats Sherwin-Williams Waterbased Tile Clad Finish B73-100 Series

c. Behr: 1 coat AquaGrip 5001 Waterborne Primer: 2 coats AquaGrip 2600 Gloss Water-Based Epoxy.

E. Decking (Ferrous Unprimed), Bar Joists (Unprimed):

1. Water-Based Acrylic Dry Fall:
   a. PPG: 1 coat DEVGUARD Low VOC Universal 4360 primer, 2 coats Speedhide WB Dry Fall topcoat 6-715.
   c. Behr: 1 coat Premium Plus Multi-Surface Primer 436; 2 coats Behr Pro Dryfall Paint 890.

F. Decking (Pre-primed/Prefinished), Bar Joists (Shop Primed):

1. Water-Based Acrylic Dry Fall:
   a. PPG: 2 topcoats Speedhide WB Dry Fall 6-715 series over prepared substrate.
   b. Sherwin-Williams: 2 coats Low VOC Waterborne Acrylic Dryfall Flat B42W81 over Prepared substrate.
   c. Behr: 2 coats Behr Pro Dryfall Paint 890 over prepared substrate.

G. Shop Primed Metal Doors, Trim, Panels and Miscellaneous Surfaces:

1. High Performance Coating, Urethane: (rust inhibitive, UV stable)
   b. Sherwin-Williams: 1 coat Recoatable Epoxy Primer 67A5, 2 coats Acrolon 218 HS Polyurethane B65W611

H.

2.5 EXTERIOR PAINT SCHEDULE

A. Shop Primed Metal Doors, Trim, Panels and Miscellaneous Surfaces:

1. High Performance Coating, Urethane: (rust inhibitive, UV stable)
   b. Sherwin-Williams: 1 coat Recoatable Epoxy Primer 67A5, 2 coats Acrolon 218 HS Polyurethane B65W611

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. Plaster and Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   5. Concrete Floors: 8 percent.

D. Test shop applied primers for compatibility with subsequent cover materials.

E. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.

B. Correct minor defects and clean surfaces which affect work of this Section. Remove existing coatings which exhibit loose surface defects.

C. Shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

H. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.

I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

K. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. 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.


N. Aluminum with Alodine Finish: Clean by lightly scuff with sandpaper. Remove all dust.

O. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

P. Interior Wood Items Schedule to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

Q. Exterior Wood Scheduled to receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.

R. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

S. Shop Finished Items: Finish in accordance with AWI standards and guide lines.

T. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

U. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:
1. Remove cracked and deteriorated sealants and calking.
2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
5. Remove mildew as specified above.
6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, request recommendation from Architect.
7. Apply specified primer to surfaces scheduled to receive coatings.

B. Gypsum Wallboard:
1. Fill cracks and voids with spackling compound.
2. Apply primer over bare surfaces and newly applied texture coatings.

C. Metal:
1. Remove rust from surfaces to bare metal in accordance with SP3 “Power Tool Cleaning”.
2. Exercise care not to remove galvanizing.
3. Complete preparation as specified for new work.

3.4 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.
B. Repair damage to other surfaces caused by work of this Section.
C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
D. Remove empty paint containers from site.

3.5 APPLICATION

A. The intent of these Specifications is to produce the highest quality appearance of paint and finish surfaces. Employ skilled mechanics only. The proper preparation of all surfaces will be strictly enforced and wherever finished surfaces show any defects due to improper preparation, workmanship, etc., the defects shall be removed and the work refinished at the expense of the Contractor.
B. Apply products in accordance with manufacturer's instructions. Final finish coats shall have visual evidence of solid hiding and uniform appearance, and shall be free and smooth of brush marks, streaks, sags, runs, laps, or skipped areas.
C. Do not apply finishes to surfaces that are not dry.
D. Apply each coat to uniform finish and thickness.
E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
F. Sand lightly between coats on wood and metal items to achieve required finish.
G. Allow applied coat to dry before next coat is applied.
H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
I. Prime back surfaces of interior and exterior woodwork scheduled to be painted with primer paint.
J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
K. Edges of paint adjoining other materials or colors shall be sharp and clean with no overlapping.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint all shop primed equipment. Paint shop prefinished items where exposed to view in finished spaces. In mechanical rooms, repair shop pre-finished coatings which have been scratched or otherwise damaged with identically touch-up paint. Sand prior to touching up as required.
B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
C. Paint all grilles, registers, diffusers, and speaker grilles to match adjacent wall and ceiling surfaces, except that factory pre-finished items need not be painted if installed in a suspended acoustical ceiling system where the acoustical panels match the mechanical or electrical item color.
D. In all finished spaces, prime and paint exposed pipes, conduit, boxes, ducts, hangers, brackets, collars and supports. Paint to match adjacent surfaces.
E. Repair or replace identification markings on mechanical or electrical equipment when painted accidentally.
F. Paint interior surfaces of air ducts and convectors that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and convectors to match face panels.
G. Paint all surfaces of plywood backboards for electrical and telephone equipment before installing equipment.
H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.
I. Paint exposed air handlers, roof ventilators, goose necks, exhaust fans and other items on the roof with 2 coats exterior enamel. Prepare surfaces in accordance with the base metal or primer as specified herein.
J. Paint concrete support bases with gray floor deck enamel.
K. Pipe hangers and other supports need not be painted except where installed in crawl spaces, where they shall be painted with a thick coat of asphaltic paint.

3.7 CLEANING/TOUCH-UP

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
D. Spot painting will be allowed to correct soiled or damaged paint surfaces only when touch-up spot will blend into surrounding finish and is invisible to normal viewing (as determined by the Architect). Otherwise, re-coat entire section to corners or to a visible stopping point.
3.8 V.O.C. (VOLATILE ORGANIC COMPOUND) COMPLIANCE

A. Products listed in following schedule 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.

END OF SECTION
SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY
A. Related Documents: Provisions established in Conditions of the Contract, Division 01 - General Requirements, and the Drawings are collectively applicable to this Section.
B. Section Includes
   1. Identifying devices where shown on the Drawings complete and as specified including the following:
      a. Interior code required signs.

1.2 SUBMITTALS
A. Product Data: Include manufacturer’s construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
B. Shop Drawings: Provide shop drawings for fabrication and erection installation of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, accessories, layout, and installation details.
C. Samples for Verification:
   1. Physical: Submit samples of one competed sign for review and approval. Approved sample may be incorporated into Project.
   2. Color: Submit manufacturer’s standard color selection chart. Do not proceed until colors have been selected, reviewed and approved.
D. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. Low-Emitting Materials
      a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
         1) Paints and coatings.
         2) Adhesives and sealants.
         3) Flooring.
         4) Products containing composite wood or agrifiber products or wood glues.
         5) Ceilings, walls, thermal, and acoustical insulation
      b. Product data for wet-applied products applied on site meeting the following requirements:
         1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
         2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
   5. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.3 QUALITY ASSURANCE
A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.
B. Manufacturer shall have a minimum of five years experience in the manufacturing of signs specified.
C. Codes and Standards:
   1. Panel signs shall have 1/32-inch raised copy and grade 2 Braille, and shall comply with all existing federal, state, and local accessibility standards.
   3. Comply with the State of Texas Accessibility Standards, 2012 edition, as administered by the Texas Department of Licensing and Regulation.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL
A. Paints and Coatings
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
B. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
C. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.
D. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
c. Cradle to Cradle certifications.
d. Declare product labels.

2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 MANUFACTURERS
   A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:
      1. ASI Signs, Houston, Texas.
      2. Graphitec, Houston, TX
      3. Sparq1200, Houston, TX
      4. National Signs, Houston, TX

2.3 ROOM SIGNAGE SYSTEMS (INTERIOR CODE REQUIRED SIGNS)
   A. Sign Face: Clear acrylic, 0.080 inch thick, matte first surface.
   B. Tactile Graphics and Text:
      1. Fabrication: Provide tactile copy and grade 2 Braille raised 1/32 inch minimum from plaque first surface by manufacturer's stratification process as follows:
         a. Refer to drawings, photo-mechanical method.
      2. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors.
   C. Non-Tactile Graphics and Text:
      1. Fabrication options:
      2. Text or graphic technique:
         a. Screen process using subsurface method.
      3. Provide lettering and graphics precisely formed, uniformly opaque, and consistent in size, style, spacing, content, position, and colors.
   D. Evacuation Map: Architect to provide one sample egress map artwork, signage contractor to provide all egress maps needed.
   E. Overall panel size: As required to meet code requirements
   F. Panel colors: As selected by Architect.
   G. Text or graphic colors: As selected by Architect.
   H. Letter styles, colors, letter sizes and layout position: As selected by Architect.
   I. Installation Method: System SA, silicone adhesive

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE
   A. Deliver and store identifying devices in protective wrappings until ready for installation. Install letters in protective wrappings and remove wrappings just prior to substantial completion.

3.2 INSTALLATION
   A. Install signs plumb, level and square and in proper planes with other work, at heights required by accessibility codes and standards.
   B. Anchor each plastic laminate sign with adhesive.
   C. Install signs with sufficient amount of foam tape for proper installation.
   D. Attach as recommended by sign manufacturer.
   E. Anchor each sign with adhesive.
   F. Coordinate arrival and installation of graphic signs with hardware installation. Graphic signs function as and are coordinated with the hardware as shown on the Drawings.
   G. Room name signs shall be placed on the public side of the door except where noted otherwise.
   H. Single Door Sign: Provide one sign as specified above, mounted to wall adjacent to door on knob side.
   I. Pair of Doors: Provide one sign as specified above, mounted to adjacent wall closest to active leaf of door. Do not install sign where it will be obstructed by door when door is in the 'open' position.
J. Attachment: Mounting to surfaces shall be done by pressure sensitive frame double-faced tape. Signs shall be delivered to the project site with the tape in place and trimmed on each sign, but with the protective paper layer not removed. Paper layer shall be removed just prior to installation of signs.

3.3 COORDINATION
   A. Coordinate the installation of the identifying devices with the hardware manufacturer for lockset and knob leaf outs as detailed and scheduled.

3.4 DAMAGE
   A. Any identifying device which is scratched or defaced will be rejected.

3.5 CLEANING
   A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

END OF SECTION
SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards.

1.3 PERFORMANCE REQUIREMENTS
A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform load of 50 lbf/ft. applied in any direction.
   2. Concentrated load of 200 lbf applied in any direction.
   3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 ACTION SUBMITTALS
A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
B. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. Low-Emitting Materials:
      a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
         1) Paints and coatings.
         2) Adhesives and sealants.
         3) Flooring.
         4) Products containing composite wood or agrifiber products or wood glues.
         5) Ceilings, walls, thermal, and acoustical insulation
      b. Product data for wet-applied products applied on site meeting the following requirements:
         1) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
      c. Composite woods documented to have low formaldehyde emissions that meet the CARB ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
   5. BPDO – Environmental Product Declarations
      a. Product-specific declarations of lifecycle impacts
      b. Industry-wide (generic) Type III EPD
      c. Product-specific Type III EPD.
   6. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
3) Cradle to Cradle v2 Basic level or v3 Bronze level
4) Declare product labels.

b. Products that have undergone chemical inventory and screening through the following initiatives:
   1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
   2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
   3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

C. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.

1.5 INFORMATIONAL SUBMITTALS
   A. Material Certificates: For each impact-resistant plastic material, from manufacturer.
   B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
      1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.7 QUALITY ASSURANCE
   A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
   C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."
   D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
   E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and Texas Accessible Standards (TAS).

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
      1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
      2. Keep plastic sheet material out of direct sunlight.
      3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
         a. Store corner-guard covers in a vertical position.
         b. Store wall-guard, bed-locator, and handrail covers in a horizontal position.

1.9 PROJECT CONDITIONS
   A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 WARRANTY
   A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
      1. Failures include, but are not limited to, the following:
PART 2 - PRODUCTS

2.1 MATERIALS

A. Adhesives and Sealants
   1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (VOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
      a. 0.5mg/m3 or less,
      b. Between 0.5 and 5.0 mg/m3 or,
      c. 5.0 mg/m3 or more.
   2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

B. Additional Low-Emitting Requirements
   1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
   2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
   3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

C. BPDO – Environmental Product Declarations
   1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
      a. Product-specific declaration of lifecycle impacts
      b. Industry-wide (generic) EPD
      c. Product-specific Type III EPD

D. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

E. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.
   1. Chemical and Stain Resistance: Tested according to ASTM D 543.
   2. Self-extinguishing when tested according to ASTM D 635.
   3. Flame-Spread Index: 25 or less.
   4. Smoke-Developed Index: 450 or less.

F. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Balco, Inc.
   2. Construction Specialties, Inc.
   3. IPC Door and Wall Protection Systems; Division of InPro Corporation.
5. Pawling Corporation.
B. Basis of Design: Refer to Architect’s Master Schedule.

2.3 FABRICATION
A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
B. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:
1. Sheet Thickness of 0.040 Inch: 24-inch radius.
C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
D. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
E. Miter corners and ends of wood handrails for returns.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION
A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
   a. Provide anchoring devices to withstand imposed loads.
   b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
   c. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING
A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600
SECTION 102800 - TOILET, BATH, AND CUSTODIAL ACCESSORIES

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. Restroom accessories.
      2. Underlavatory guards.
      3. Custodial accessories.

1.3 ACTION SUBMITTALS
   A. Sustainable Documentation Submittals:
      1. Recycled Content:
         a. Product data and certification letter indicating percentages by weight of post-consumer and
            pre-consumer recycled content for products having recycled content.
         b. Include statement indicating costs for each product having recycled content.
      2. Location and distance from project of material manufacturer and point of extraction, harvest, or
         recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section
         018113.01 LEED DESIGN REQUIREMENTS.
      3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b
         in Section 018113.01 LEED DESIGN REQUIREMENTS.
      4. BPDO – Material Ingredients
         a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following
            disclosure initiatives:
            1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract
               Service Registration Number (CASRN).
            2) Health Product Declaration with full disclosure of known hazards in compliance with
               the Health Product Declaration open standard.
            3) Cradle to Cradle v2 Basic level or v3 Bronze level
            4) Declare product labels.
         b. Products that have undergone chemical inventory and screening through the following
            initiatives:
            1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm
               demonstrating no Benchmark 1 hazards.
            2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum
               certification.
            3) REACH screening demonstrating no ingredients on the REACH Authorization or
               Candidate lists.
   B. Product Data: For each type of product indicated. Include the following:
      1. Construction details and dimensions.
      2. Anchoring and mounting requirements, including requirements for cutouts in other work and
         substrate preparation.
      3. Material and finish descriptions.
      4. Features that will be included for Project.
      5. Manufacturer's warranty.
   C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory
      required.
      1. Identify locations using room designations indicated.
      2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS
   A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.
1.6 QUALITY ASSURANCE
   A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION
   A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
   B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY
   A. Special Mirror Warranty: Manufacturer’s standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
      1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS GENERAL
   A. BPDO – Material Ingredients:
      1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
         a. Manufacturer inventory.
         b. Health Product Declarations (HPDs).
         c. Cradle to Cradle certifications.
         d. Declare product labels.
      2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
         a. Greenscreen.
         b. Cradle to Cradle.
         c. REACH.

2.2 MATERIALS
   A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
   B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
   C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
   E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
   F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 RESTROOM ACCESSORIES
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. American Specialties, Inc.
      2. Bobrick Washroom Equipment, Inc.

2.4 UNDERLAVATORY GUARDS
   A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1. Plumberex Specialty Products, Inc.
      2. Truebro by IPS Corporation.
   B. Underlavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.

2.5 CUSTODIAL ACCESSORIES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.

2.6 FABRICATION
A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner’s representative.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING
A. Adjust accessories for unencumbered, smooth operation. 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 102800
SECTION 104313 - EMERGENCY AID CABINETS AND DEFIBRILLATOR

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes the following:
      1. Automated external defibrillator (AED) cabinets.
      2. Defibrillators

1.2 SUBMITTALS
   A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for AED cabinets.
      1. Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
      2. Show location of knockouts for conduit and wiring.
   B. Samples for Verification: For each type of exposed factory-applied color finish required for AED cabinets, prepared on Samples of size indicated below.
      1. Size: 6 by 6 inches square.
   C. Maintenance Data: For AED cabinets to include in maintenance manuals.
   D. Sustainable Documentation Submittals:
      1. Low-Emitting Materials: Provide product data indicating compliance with low-emitting criteria as described in section 018113.01 – LEED Design Requirements.
      2. BPDO – Environmental Product Declarations Credit: Provide product data indicating compliance with lifecycle impact reporting as described in section 018113.01 – LEED Design Requirements.
      3. BPDO – Sourcing of Raw Materials Credit: 
         a. Recycled Content: Provide product data with recycled content information indicated as described in section 018113.01 – LEED Design Requirements.
      4. BPDO – Material Ingredients Credit: Provide product data indicating compliance with chemical inventory and/or screening as described in section 018113.01 – LEED Design Requirements.

1.3 QUALITY ASSURANCE
   A. Fire-Rated AED Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.4 COORDINATION
   A. Coordinate size of AED cabinets to ensure that type and size of defibrillators to be provided by the Authority are accommodated.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS
   A. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.02 – Sustainable Design Requirements.
   B. Low Emitting Requirements: Provide product that meets low emitting criteria listed in section 018113.01 – LEED Design Requirements.
   C. BPDO – Environmental Product Declarations Credit: Provide product that meets lifecycle impact reporting criteria listed in section 018113.01 – LEED Design Requirements.
   D. BPDO – Sourcing of Raw Materials Credit:
      1. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 35 percent.
   E. BPDO – Material Ingredients Credit: Provide product that meets material ingredient inventory and/or screening criteria listed in section 018113.01 – LEED Design Requirements.

2.2 MATERIALS
   A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.
   B. Stainless-Steel Sheet: ASTM A 666, Type 304.
   C. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), not less than 1.5 mm thick, with Finish 1 (smooth or polished).
2.3 AUTOMATED EXTERNAL DEFIBRILLATOR (AED) CABINET
A. Basis-of-Design Product:
   1. JL Industries, Inc.,
   2. Cabinet with Stainless Steel Trim and Door: 1400 Lifestart™ Series, Model 1436F12
      a. Door and Trim Construction: Stainless steel; flush doors with 5/8 inch (15.88 mm) door stop attached by continuous hinge and equipped with zinc-plated with roller catch.
         1) Finish: Factory-applied ground and polished finish.
         2) Standard Finish: #4 directional satin finish.
         3) Door Style:
            a) Style F12: Full Acrylic Glazing; Pull & AED Graphics
      b. Trim Style and Depth:
         1) Semi-Recessed Cabinet:
            a) Square Edge: 1-1/2 inch.
         2) Trim Dimensions: 1-3/4 inch face trim on door and frame.
   3. Fire-Rating: Nonfire-rated or Fire-Rated as necessary to match rating of fire rated partition.
   4. Alarms: Standard: 85 db Commander (audible) cabinet-mounted alarm standard (battery operated) to protect against theft or tampering. Alarm deactivated when door is closed.
B. Accessories:
   1. Defibrillator: Install defibrillator in each cabinet.

2.4 FABRICATION
A. AED Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.
      a. Provide factory-drilled mounting holes.
B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
   2. Miter and weld perimeter door frames.
C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 FINISHES, GENERAL
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Finish cabinets after assembly.

2.6 STAINLESS-STEEL FINISHES
A. General: Remove tool and die marks and stretch lines or blend into finish.
   1. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
B. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Prepare recesses for AED cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION
A. Install AED cabinets in locations and at mounting heights indicated on Drawings. Fasten cabinets to structure, square and plumb.
3.4 INSTALLATION OF FIRE-RATED CABINETS
   A. Install cabinet with not more than 1/16-inch tolerance between conduit OD and knockout OD. Center conduit within knockout.
   B. Seal through penetrations with firestopping sealant as specified in Division 07 Section "Penetration Firestopping."

3.5 ADJUSTING AND CLEANING
   A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed, unless otherwise indicated in manufacturer's written installation instructions.
   B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
   C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
   D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.
   E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
SECTION 104413 - FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.

1.3 ACTION SUBMITTALS
A. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recovery of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
         2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
         3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.
   B. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
   C. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
   D. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.

1.4 COORDINATION
A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 GENERAL
A. BPDO – Material Ingredients:
1. **Option 1:** Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.

2. **Option 2:** Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 **PERFORMANCE REQUIREMENTS**

A. **Fire-Rated Fire-Protection Cabinets:** Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 **FIRE-PROTECTION CABINET**

A. **Cabinet Type:** Suitable for fire extinguisher.

1. **Products:** Subject to compliance with requirements, provide products by one of the following:
   a. JL Industries, Inc.; a division of the Activar Construction Products Group.
   b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
   c. Larsens Manufacturing Company.
   d. Potter Roemer LLC.

   1. **Basis of Design:** Refer to Architect’s Master Schedule.

B. **Cabinet Construction:** Non-rated in non-rated walls; 1 or 2 hour fire rated in rated walls to match rating of wall.

1. **Fire-Rated Cabinets:** Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. **Door Hardware:** Manufacturer’s standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

D. **Accessories:**

1. **Mounting Bracket:** Manufacturer’s standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. **Identification:** Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

   a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      1) Location: Applied to cabinet door.
      3) Lettering Color: Black.
      4) Orientation: Vertical.

   b. In addition to providing cabinet identification, provide triangular signage above each extinguisher identifying the device from both sides.

E. **Materials:**

1. **Cold-Rolled Steel:** ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
   a. Finish: Baked enamel or powder coat.
   b. Color: As selected by Architect from full range of industry colors and color densities.

2. **Tempered Float Glass:** ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 **FABRICATION**

A. **Fire-Protection Cabinets:** Provide manufacturer’s standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
   2. Miter and weld perimeter door frames.
C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS
B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
C. Finish fire-protection cabinets after assembly.
D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION
A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
   4. Fire-Rated Cabinets:
      a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD.
      b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

3.4 ADJUSTING AND CLEANING
A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413
SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
      a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS
A. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
   4. BPDO – Material Ingredients
      a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
         1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
         2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
         3) Cradle to Cradle v2 Basic level or v3 Bronze level
         4) Declare product labels.
      b. Products that have undergone chemical inventory and screening through the following initiatives:
         1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
         2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
         3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.
   B. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
   C. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS
A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION
A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.
1.8 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS GENERAL
A. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
b. Health Product Declarations (HPDs).
c. Cradle to Cradle certifications.
d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
b. Cradle to Cradle.
c. REACH.

2.2 PERFORMANCE REQUIREMENTS
A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS
A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. JL Industries
      b. Amerex Corporation.
   1. Basis of Design: Refer to Architect’s Master Schedule
   2. Valves: Manufacturer's standard.
   3. Handles and Levers: Manufacturer's standard.
   4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
B. Multipurpose Dry-Chemical Type: UL-rated, 10 lb capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
C. Purple-K Dry-Chemical Type in Aluminum Container (in common use kitchens): UL-rated 10-B:C, 2.5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.4 MOUNTING BRACKETS
A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. JL Industries
      b. Amerex Corporation.
B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine fire extinguishers for proper charging and tagging.
      1. Remove and replace damaged, defective, or undercharged fire extinguishers.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
      1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
   B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416
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SECTION 114000 – FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK
A. Approval of Working Surface: any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. Beginning of work by any contractor shall constitute acceptance of the previous work.
B. Checking Dimensions at Site: before ordering any materials or doing any work, verify all measurements of the building and be responsible for the correctness of them. No extras will be allowed for variations from drawings in existing conditions or for work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.
C. Cutting and Patching: no excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true and of the proper size in his work as may be necessary for the proper installation of his and other contractors' work. After such work has been installed, he shall carefully fit around, close up, repair, patch and point up same as directed, to the entire satisfaction of the Architect.
D. Cooperation: the General Contractor, all other contractors and all subcontractors shall cooperate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity for installation of their work and storage of their material.
E. Inspection and Tests: Architect and his representative shall at all times have access to the work whether it is in preparation or progress. Provide proper and safe facilities for such access and inspection.
F. Fees, Permits and Inspections: secure and pay fees for all permits, licenses and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, rules, regulations and contract requirements bearing on the work.

1.3 SCOPE
A. Include the Work specified, shown or reasonably inferable as part of Foodservice Equipment. Portions of this Work may be subcontracted to those qualified to do such work, as may be necessary because of jurisdictional trade agreements and restrictions.

NOTE: THIS ARTICLE DOES NOT INCLUDE OR INFERENCE THAT THE FOODSERVICE EQUIPMENT CONTRACTOR IS RESPONSIBLE FOR THE HIRING OF SUB-TRADES OR CONSTRUCTION SERVICES TO INSTALL THE EQUIPMENT OTHER THAN AS DIRECTLY SPECIFIED AS BEING PART OF THE FOODSERVICE CONTRACTOR RESPONSIBILITY, I.E. PRE-PLUMBING OR PRE-WIRING OF FABRICATED EQUIPMENT; INTERCONNECTION OF HOODS (PLUMBING/ELECTRICAL) WHEN REQUIRED; PRE-WIRING JUNCTION BOXES AT TOP OF COLD STORAGE ASSEMBLIES FOR SINGLE POINT CONNECTION; INSTALLATION OF CONDENSATE DRAINS AND DRAIN LINE HEAT TAPE WITHIN THE COLD STORAGE ASSEMBLIES, ETC.

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS
A. Counter front finish/material at exposed front/ends of cafeteria serving counters: Division 06.
B. Corner guards: Division 09.

C. PVC or EMT Conduit with pull-wire and wide-sweep bends for remote beverage dispensing systems: Division 22/26.

D. PVC or EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote foodservice equipment refrigeration systems: Division 22/26.

E. Empty EMT conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPU’s, etc.: Division 27.

F. Supply and exhaust fans for foodservice equipment and exhaust hoods: Division 23.

G. Structural steel support members/framing above 12'-0" aff. for ceiling mounted appliances/fixtures: Division 05.

H. Roughing-in and final connection of mechanical, electrical and plumbing systems to Fixed, Movable Foodservice Equipment and Cold Storage Assemblies: Divisions 22/23 and 26/27.

I. Millwork fixtures (e.g., checker stands, service stations, buffet counters): Division 06.

1.5 EQUIPMENT FURNISHED/INSTALLED BY OTHERS

A. Obtain and coordinate utilities requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and roughing-in drawings/provisions.

B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.6 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with Owner not less than ninety (90) days before equipment requirement.

B. Obtain and coordinate utilities requirements of OF/CI equipment with the building utilities and roughing-in drawings/provisions.

C. Receive at job-site and fully incorporate into installation procedures as if furnished under this Section.

1.7 QUALITY ASSURANCE

A. In addition to complying with applicable laws, statutes, building codes and regulations of public authorities, comply with the following:
   1. National Sanitation Foundation (all equipment to bear label).
   3. Underwriters’ Laboratories, Inc.
   6. Americans with Disabilities Act
   7. Food and Drug Administration HAACP Guidelines.
   8. Clean Air Act Title 6.

B. Furnish certification of regularly-manufactured equipment listing or classification by Underwriters’ Laboratories, Inc. or other recognized test facility with initial submittal.

1.8 SUBSTITUTIONS

A. Equipment items or components specified are intended to be the Basis of Bid. All other brands, including any additional names which may be listed as “Alternates” or “Approved Equal,” must conform with the specifications, size, accessories, etc. of the first-named brand and be subject to Paragraph C-03 of this Article. All appliances within common group or category (e.g., refrigerators, kettles, ovens, etc.): same manufacturer.

B. Proposed Substitutions:
   1. Submitted no less than 14 calendar days prior to Bid Date.
2. Submit proposed substitutions with catalog data and/or manufacturers shop details indicating all modifications required to conform with specified brand.

C. Substitutions with prior approval:
1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.
2. Owner reserves the right to accept or reject any or all substitution proposals before execution of Contract.
3. Provide all design/engineering services required to make adjustments in space, systems, utilities, etc. and pay all additional costs of utilities, construction or professional services that may be incurred due to the acceptance of any substitution.

1.9 INTERPRETATION OF DOCUMENTS
A. During Bidding: contractors', suppliers' or vendors' questions and comments pertaining to Construction Documents' clarity or intent will be addressed by addendum.

B. Subsequent to Award:
1. Confirmation of Construction Document requirements will be provided by Clarification Bulletin.
2. Request For Information Bulletins submitted by Contractor: contain Contractor's proposed resolution.

1.10 WARRANTY
A. Provide a written warranty for a period of one year from the date of Substantial Completion, including extended four-year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement prior to one-year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.

C. Refrigeration Systems/Equipment: one year free service available within twenty-four hours of notification.

D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number and name of person to contact. Whenever possible, the service agencies selected shall be factory-authorized for the equipment assigned.

1.11 SUBMITTAL DATA
A. Special Requirements: the following are in addition to any general requirements given elsewhere in the Documents.

B. All drawings and other submittals: indicate Worrell Design Group, Inc. as foodservice consultant.

C. Sustainable Documentation Submittals:
1. Recycled Content:
   a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
   b. Include statement indicating costs for each product having recycled content.

2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.

3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.

4. BPDO – Material Ingredients
   a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
      1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
      2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
      3) Cradle to Cradle v2 Basic level or v3 Bronze level
      4) Declare product labels.
b. Products that have undergone chemical inventory and screening through the following initiatives:
   1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
   2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
   3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

D. Brochure Format (for regularly-manufactured equipment and components):
   1. Front and rear protective cover with labeled project name.
   2. Brochure index: indicate functional Area/Room number, item number, quantity, description and manufacturer.
   3. A separate fly sheet for each component or item of equipment, indicating: item number, name, quantity, manufacturer, optional equipment, modifications, special instructions and utility requirements. An item of equipment or assembly containing more than one buyout sub-assembly or component shall have the secondary item listed in parenthesis beside the primary item name. For example: Serving Counter (hot food well).
   4. Catalog specification sheet and manufacturer's drawing.
   5. Certification letter of equipment listing or classification by Underwriters' Laboratories, Inc. or other recognized testing facility.

E. Shop Drawings (Rough-In Drawings):
   1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced).
   2. ¼” scale drawing of fixed/movable Foodservice Equipment and pre-fabricated Cold Storage Assemblies with itemized schedules.
   3. Special Conditions Drawings, sizing and locating the following conditions:
      a. Slab depressions, cores, sleeves or block-outs (cold storage assemblies, drain trenches, piping, etc.).
      b. Concrete or masonry platforms.
      c. Pipe sleeves or roof jacks.
      d. Wall-openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.
      e. Blocking grounds or anchor plates required in walls for equipment support/attachment.
      f. Above-ceiling hanger assemblies for support of exhaust hoods, utensil-racks, etc.
      g. Access panels in walls or ceiling for service of equipment.
      h. Ceiling pockets or recesses for unusually high equipment.
      i. In-wall carriers for wall-hung or cantilevered equipment.
   4. Electrical rough-in drawing.
   5. Plumbing/mechanical rough-in drawing.
   6. Required information:
      a. All fixed and movable Foodservice Equipment shown on Contract Drawings.
      b. All prefabricated Cold Storage Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.
      c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices not in this Section.
      d. All rough-in drawings: fully dimensioned from engineering benchmark or finished-room surface to point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical and plumbing services.
      e. Connection number/tag system and symbols: identical to Contract Drawings.
   7. Foodservice equipment not in this section:

F. Shop Drawings (Manufacturer's and Fabricator's):
   1. Sheet Size: identical to Contract Drawings, drawn or plotted at ¾” scale for plan view and elevations; 1½” scale for sections and construction details.
   2. Included information: item number, name and quantity.
   3. Construction details, sections and elevations to reflect requirements of the Specifications and Drawings.
   4. Indicate adjacent walls, columns and equipment.
   5. Indicate plumbing and electrical schematic drawings for equipment such as: conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems and fabricated fixtures with single electrical or plumbing connection.
6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment or replacement of all moving parts.

G. Regular Submittal:
1. After the return of one copy of the preliminary submittal, resubmit for approval.
2. Follow routine procedures specified elsewhere or as directed.
3. All data and material: thoroughly reviewed for compliance by Contractor prior to submittal. Foodservice Consultant's repetitive reviewing time (more than twice) incurred due to the Contractor's failure to comply with the requirements of this Article may be invoiced to this Contractor at Consultant's standard hourly rates.

1.12 SERVICE MANUAL
A. Three copies bound in 1½” hardback, three-ring binders (as many volumes as required by scope of project) with same data as brochure at completion of installation (Refer to "Submittal Data").
B. Each Volume: section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).
C. Catalog specification sheet and/or manufacturer's shop drawings.
D. Each Volume: index of items, manufacturer's operating/maintenance information, replacement parts data and price lists. Provide the name, title and address of personnel at each respective manufacturer to be contacted for spare/replacement parts after warranty period.
E. To the extent possible, provide two copies of manufacturers' video instructional cassettes for operating, maintenance and service of equipment.

1.13 VERIFICATION AND COORDINATION OF PROJECT/DATA
A. Utilities Rough-in Drawings and Field-Services within four weeks after receipt of notice-to-proceed, review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors and field-check the installed utility capacities and locations.
B. Review critical systems/components for application, performance and capacity and submit calculation worksheets with initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:
1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes and locations.
2. Refrigeration Systems (compressor, condenser and evaporator) capacities/sizes, quantities and refrigerant piping distances/sizes.
4. Locations of Vacuum Breakers.
5. Waste Water Conservation Measures required by applicable guidelines/codes (e.g., use of disposers and transfer-piping from warewash machines).
6. Solid Waste Removal/Recycling measures required by applicable guidelines/codes (e.g., separation of waste material and compaction).
7. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, walk-in refrigerators, salad bars) with HACCP Guidelines.
8. Gas, water and steam/condensate and chilled water line sizes and manifold configurations.
9. Diameter and length of flexible connector lines for fixed movable gas appliances.
10. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).
11. ADA compliance of work stations, service positions, passageways, etc.
C. Ceiling mounted appliances/fixtures: verify and coordinate dimensions/location of support framing/hangers with General Contractor. All material and installation below 12’-0” aff.: Section 114000.
D. Dimension Responsibility: obtain actual or guaranteed measurements for proper fit of equipment. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building prior to fabrication or delivery of equipment and notify the Architect of all conflicts or deviation from the dimensions shown.
E. Scheduling to Fit Openings: should it become necessary to schedule construction of walls or partitions prior to delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.

F. Refrigerated and Dry Storage Areas: verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of variance between the Contract Documents and actual conditions.

G. Color/Pattern Selections: submit selection samples of solid polymer products, plastic laminate, paint or stain finishes and vinyl-coated surface material of equipment as selected by Architect.

H. Size/Weight Coordination: obtain dinnerware size/weight information for selection/coordination of self-leveling dispensing, warewashing and transport equipment.

I. Movable Equipment Interface: rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at time of initial shop drawing submittal. Indicate conflicts and proposed adjustments.

J. Relocation of Work: relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.

PART 2 - PRODUCTS

2.1 FABRICATED FIXTURES MATERIAL/COMPONENTS

A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.

B. Stainless steel joints and seams: heli-arc welded, free of pits and flaws, ground smooth and polished to No. 4 finish.
   1. The "grain" direction of horizontal stainless steel surfaces: longitudinal, including the splashback. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

C. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.
   1. Galvanized iron joints and seams: arc-welded, free of pits and flaws and ground smooth.
   2. Galvanized sheets or shapes: washed with mineral spirits and painted with Rustoleum gray semi-gloss enamel.

D. Sound Deadening: Schnee Butyl Sealant ¾" wide tacky tape positioned continuously between all frame-members or contact material and underside of stainless steel surface (sinks, table tops, food wells, overshelves and undershelves). Tighten stud-bolts for maximum compression of sealant and trim excess.

E. Plastic Laminate: color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be N.S.F. approved (Standard No. 35).

F. Solid Polymer products: color/pattern/material as selected by Architect in thickness as specified. Solid Polymer and adhesives must be N.S.F. approved (Standard No. 51).

G. BPDO – Material Ingredients:
   1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
      a. Manufacturer inventory.
      b. Health Product Declarations (HPDs).
      c. Cradle to Cradle certifications.
      d. Declare product labels.
   2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
      a. Greenscreen.
      b. Cradle to Cradle.
      c. REACH.

H. Casters.
   1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Vertilock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.
2. Fabricated fixtures with "Closed Base" construction: Jarvis and Jarvis Model No. 5-61-161P-NSF with grease seals on forks and wheels; two casters: Model No. E-85 Vertilock brakes. Furnish Model No. B-10 corner bumpers.

I. Cutting Boards: ¾" thick read "Polylite" or TEKNO APEX "Plastic Tuff" cutting board, size as indicated.

J. Identification Plates, Labels, Tags:
1. Prohibited Information: names of foodservice equipment contractor/dealer, suppliers, fabricators and contractors.
2. Required Information: function or purpose of controls such as display light switches, food warmer controls, etc.
3. Plate Construction: engraved phenolic plastic, secured to equipment with epoxy cement or stainless steel screws. Furnish samples.

2.2 PLUMBING/MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components: furnished under this Section as follows:

NOTE: FITTING AND COMPONENTS DESCRIBED IN ITEMS 01, 02, 03, AND 04 ARE FURNISHED LOOSE FOR INSTALLATION BY DIVISION 22/23.

1. Control valves, appliance pressure regulators for water, gas and steam, and vacuum breakers: wherever required on Foodservice Equipment (chrome-plated where exposed).
2. Faucets and drains without connected overflows (unless otherwise indicated) for all sinks.
3. Specialty Foodservice water-fill faucets or hose assemblies indicated in drawings/specifications.
4. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food holding components of serving counters (e.g. cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: painted with aluminum paint where exposed, type "K" copper where concealed.
5. Piping brackets and supports beneath/within fabricated equipment.
6. Closed Base Bodies: removable 18 gauge stainless steel closure panel at plumbing penetrations, under top.
7. Control valves on Open Base fixtures: mounted on 14 gauge stainless steel gusset-shaped panel with 3½" setback from counter top edge/rim to face of control handle.
8. Fill hose/faucet at support pedestals or Closed Base Body: installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger bracket for hose.
9. In-line water filter system:
   a. Everpure System filters for coffee/tea brewers, ice makers, water chillers and beverage systems.
   b. Hako Model FS-2000 Water Conditioner for self-generating steam combi-ovens, convection steamers and kettles; Model 8PP for table top steamers.

B. Gas-Heated Equipment Fittings and Components: furnished under this Section as follows:

1. Fixed Equipment: Dormont Model No. 1600 Series "Deluxe Swivel Max Kit" with Swivel Max fittings at both ends and Quick Disconnect fitting at appliance: diameter per fuel volume/connection size requirements. Length: 48".
2. Movable Equipment: Dormont Model No.1600 Series "Deluxe Swivel Max Kit" with Swivel Max fittings at both ends, Quick Disconnect fitting at appliance: diameter size per fuel volume/connection size requirements. Length: 48".
   a. Restraining device: Dormont Model No. RDC Series - heavy duty steel cable, fastened to equipment and walls, 3" to 6" shorter than equipment connector length.
   b. PS Series Safety Set Positioning System.

C. Final Plumbing Connections Provisions.

1. Fabricated equipment containing components, fittings and/or devices indicated on Foodservice Connections Drawings to be connected to the building systems: each component, fitting or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.
2. Field-assembled equipment (e.g., prefabricated walk-in refrigerator/freezers, conveyor systems, exhaust hoods, warewash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.
3. All plumbing final connection points of equipment shall be tagged, indicating:
a. Item number.
b. Name of devices or components.
c. Type of utility (water, gas, steam, drain, chilled water).

D. Ducts and Vents.
1. All exhaust hoods not furred-in to ceiling: furnished with 18 gauge stainless steel seamless duct risers to 6" above finished ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel angle flange with all corners welded.
2. Exhaust hoods which are furred-in to ceiling: 2" high duct collar for final connection to duct system.

2.3 FOODSERVICE EQUIPMENT REFRIGERATION SYSTEMS
A. Install complete with all refrigerant, oil, dials, dehydrators, gauges, controls required for the proper operation of the system.
B. Self-contained or factory-installed compressors: check and adjust to proper operating temperature prescribed by FDA/HACCP.

2.4 PLUMBING TRIM
A. Faucets: furnished for all sinks or equipment requiring open water supply.
C. Drain Fittings: furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless steel fittings in die-stamped openings with washers and locknuts. Solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS
A. All electrical systems, components and accessories within the work of this Section: certified to be in accordance with NEC 70.
B. Electrical Fittings and Components: furnished under this Section as follows. Coordinate foodservice equipment loads, voltage and phase with building system and confirm any existing or OF/OI equipment requirements.
C. Cord and Caps.
1. Coordinate all Foodservice Equipment cord/caps with related receptacles.
2. All 120 volt "plug-in" equipment shall have Type SO or SJO cord and plug with ground wire fastened to frame/body of item.
3. Cord lengths for fixed equipment: adjusted to eliminate loose-hanging excess.
4. All non-fixed plug-in "buy-out" equipment: Hubbell configuration, ratings as required.
5. All mobile equipment: equipped with Kellems strain-relief assembly at the cord connection of the appliance.
6. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8'-0" cord length with cord-hanger strap secured to rear of equipment or mobile stand.
D. Switches and Controls.
1. Each motor-driven appliance or electrically-heated unit: equipped with control switch or starter per Underwriters’ Laboratories, Inc. with low-voltage and overload protection.
2. Equipment which is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly-connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.
3. All remote manual starters, disconnect switches, magnetic contactors or starters and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.
4. All 208/240 volt and 460/480 volt equipment or devices: integral, pre-wired step-down transformer to provide 120 volt control circuit.
E. Motors.
1. 120 volt motors: manual tumbler type starter with thermal overload protection and interchangeable heating elements.
2. 208/240 volt and 460/480 volt motors: magnetic starter with low-voltage protection and one interchangeable overload relay per phase.

F. Heating Elements.
1. Electrically-heated equipment: thermostatic controls.
2. Water heating equipment: UL listed. Equipped with positive low-water shut-off.

G. Receptacles and Switches.
1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12" x 8½" x 3" deep recessed mounting panel sloped on 60° angle and turned up to top of opening.
2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6" from bottom of utility or compressor compartments.
3. Receptacles mounted on Open Base fixtures: installed on 12" x 10½" x 4½" deep 14 gauge stainless steel panel with returned ends and sloping recess. Secure panel to underframe of fixture top.
4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on underside of lower shelf. Vertical runs of wiring: made in rigid conduit or within the tubular leg.
5. Receptacles installed in/on fabricated equipment: Hubbell, Inc. assemblies horizontally-mounted in a metal box with stainless steel cover plate.
6. Switches installed in/on fabricated equipment: Hubbell, Inc. with metal box and stainless steel cover plate. Switches: pre-wired to the controlled device and to a junction box installed within 6" from bottom of utility or compressor compartment. All refrigeration system switches: installed within the compressor compartment near the door opening.
7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to load center with balanced phase loading. Load center: ready for final connection by Division 26 and flush-mounted within utility compartment rear panel, set back 8" from access door. All breaker/device information: typewritten on circuit schedule in load center door (number corresponding breaker/device) with enclosed schematic wiring diagram of fixture components.

H. Light Fixtures.
1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).
2. Fluorescent Display Light: install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.
3. Heat Lamps: installed to underside of serving shelf assemblies. When multiple 24" heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remote from lamps.
4. Cold Storage Light Fixtures: electrically connected through the hub fitting located on the top of the fixture. All horizontal conduit: above ceiling panels. Install plastic sleeve through ceiling panels for electrical conduit. Seal sleeved penetrations airtight at both sides of panel.

I. Final Electrical Connection Provisions.
1. Fabricated equipment containing electrically-operated components or fittings indicated on Utility Connections Drawings: direct-connected, with each component, fitting or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.
2. Fabricated equipment containing electrically-operated components and/or devices indicated: circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.
3. Field-assembled equipment (e.g., prefabricated cold storage assemblies, conveyor systems, exhaust hoods, warewash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connections Drawings by Division 26.
4. Pre-wire the following groups of cold storage assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).
   a. Light fixtures and switches; heated pressure-relief vent.
   b. Door/jamb heaters.
   c. Evaporator fans, defrost elements and drain line heaters.
5. All electrical final connection points of equipment shall be tagged, indicating:
   a. Item number.
   b. Name of devices on circuit.
   c. Total electrical load.
   d. Voltage and phase.
J. Lamps: in all Foodservice Equipment containing light fixtures. Refrigerator or heated cabinets: G.E. Model No. 40A15 appliance bulbs. All exposed fluorescent lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.

2.6 CUSTOM - FABRICATED/ASSEMBLED UNITS
A. All fixtures within this Section: constructed and installed by one manufacturer of uniform design and finish:
B. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer. The service access panel(s) size and placement is to permit easy lubrication, adjustment or replacement of all moving parts and is to be indicated on fabrication shop drawings.

2.7 COUNTER/TABLE TOPS
A. 14 gauge stainless steel; all free edges turned down 2" with ¾" tight hem at bottom. Free corners: rounded on ¾" radius.
B. Marine edges: turned up ½" on 45° angle and turned down 2" with ¾" tight hem at bottom.
C. Tops abutting high fixtures or walls: cove up specified height and slope back 1½" at top on 45° angle; 2½" slope where piping occurs. Turn down 1" at rear of splash and close ends to bottom of top turn-down. Secure splash turndown to wall with 4" long 14 gauge stainless steel "Z" clip anchored to wall, 36" o.c.
D. Freestanding tables and all serving counter splash-risers: turned back on 90° angle with 1" turndown at rear.
E. Brace tops with 1" x 4" x 1" x 14 gauge galvanized channel underbracing between each pair of legs and at center line of top. Tops greater than 30" deep two cross braces evenly spaced between each of legs. Paint channel under bracing with Rustoleum gray semi-gloss enamel. Under bracing: secured to underside of top surfaces with ¼" studs welded 9" o.c. maximum with chrome-plated washer, lockwasher and capnut. Studs: such length that cap nuts can be made-up tight, bringing top down snugly on angle frame eliminating all vibrations or "oil-canning".
F. Tops: 1½" overhang at free sides of underframe or Closed Base Body.
G. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly * OR * integrally-welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground and polished to match top.
H. All openings in tops: 3/16" high raised die-formed edges.
I. All top openings for pans or inserts: 20 gauge stainless steel, watertight liners, 8½" deep, secured to underside of counter top.
J. All "built-in" and "drop-in" counter equipment/appliances: with framing members at perimeter of opening.

2.8 DRAIN TROUGHS
A. 14 gauge stainless steel welded integrally with counter top. Troughs: 4½" x 2" deep with coved interior sloped ½" to Component Hardware Model No. E16-4011 waste sockets @ 24" o.c. with No. E01-4091 Neoprene washer and No. E02-4090 locknut. Interconnect and extend to utility enclosure and indirect waste connection.
B. Anti-splash Drainer: stainless steel wire mesh secured to ½" x ½" 16 gauge stainless steel angle frame with all sides turned down to rest on ¼" stainless steel crossrod supports, set ½" below top at 12" o.c. Weld all corners and install one finger ring per drainer section. Equal-length drainer sections: 24" long, maximum.

2.9 DRAWERS
A. Liners: Component Hardware Model No. S80-1520 (15" x 20"), easily removable with drawer in fully-extended position.
B. Drawer Frame: 16 gauge stainless steel flanged out at top. Weld the frame to double-paneled 16 gauge stainless steel drawer front with full-length recessed pull at top (similar profile as Garcy Model No. R-1060) with closed ends.

C. Channel-formed horizontal pull: ¾" turndown at front and ends with ½" tight hem. Front edge of pull: flush with face of drawer. Recess behind pull: sloped up on 60° angle, terminating 1" below bottom edge of pull.


E. Each Drawer Housing: welded 14 gauge locking hasp fitted neatly through a slot in the drawer front to accommodate padlock by Owner.

F. Drawer enclosure in an Open Base Fixture: 18 gauge stainless steel flanged out at top for attachment to underside of table top. Lower edge of enclosure is flanged in toward open bottom. Mount drawer slides to enclosure and brace as required. Face of enclosure is to be same length and height of drawer face. Provide ¾" deep offset in front of enclosure and 2½" from underside of table top for flush-fitting appearance. Drawer enclosure on freestanding fixture: full-depth of table framing.

G. Drawer enclosure in a Closed Base Fixture: completely partitioned from adjoining area. Drawer front: flush-fitting with face of body.


I. Cash Drawer: integral stainless steel body, 3" deep.

2.10 SINKS

A. 14 gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 18 gauge stainless steel apron, wrap 1 1/2" at sides and bottom.

C. Sinks with dimension larger than 20" x 20" (no overflow): score and slope sink bottom ½" to die-stamped opening fitted with Component Hardware Model No. D50-7200 rotary drain. 14 gauge stainless steel bracket: welded to sink bottom for drain stem with 1½" handle clearance.

D. Sinks with dimension of 20" x 20" or less (with overflow): score and slope sink bottom ½" to die-stamped opening fitted with Component Hardware Model No. D50-7215 rotary drain with connected overflow. 14 gauge stainless steel bracket: welded to sink bottom for drain stem with 1½" handle clearance.

E. Where sinks are installed in fixture with Closed Base Body, provide a Component Hardware Model No. D50-7215 rotary drain with connected overflow. (Sinks with dimension larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14 gauge stainless steel bracket: welded to sink bottom.

F. When single-hole deck-mounted faucets are specified, install overflow fitting in side wall of sink compartment and provide ell-fitting in connecting tubing.

G. Flush Covers: ¾" thick READ "Polylite" or TEKNOR APEX "Plastic-Tuff" cutting board with all corners and edges eased and two 1" finger holes. Support clips: ¼" stainless steel rod 2" long, formed at 45° with two ¾" leg ends (¼" long threaded ends). Insert rod-clips through tight-clearance holes in sink, seal watertight and secure with stainless steel acorn-nuts or tack-weld at exterior of sink wall. Set support clips ½" below top. Provide 14 gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: adjacent to sink compartment, below counter top or under drawer assembly.

2.11 DISHTABLES

A. Soiled/clean dishtable: 14 gauge stainless steel; free edges coved up 3" with 1½" diameter rolled rim and bullnosed corners.
B. Dishtable integral with conveyor assembly: slider bed surface of conveyor assembly shall be 1" above soiled dishtable top with integral 45° sloped riser.

C. Edge of dishtables next to high fixtures or walls: covered up 10" and sloped back 1½" on 45° angle; 2½" slope where piping occurs. Turn down 1" at rear of splash and secure to wall with 6" long 14 gauge stainless steel "Z" clips anchored to wall, @ 36" o.c.

D. Exposed rear splash: 16 gauge stainless steel finish panel from top of splash to bottom edge of rolled rim with welded vertical joint at end. Secure panel with concealed attachment and install bracing 24" o.c.

E. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot to sinks, scuppers or warewash machines, maintaining level crown/splash.

F. Brace dishtables with 1" x 4" 12 gauge stainless steel channels down centerline of top and between each pair of legs, with closed ends. Bracing: secured to underside of dishtable with ¼" studs welded 6" o.c. maximum, with chrome-plated washer, lockwasher and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel-members, eliminating all vibration and "oil-canning."

G. Integrally-welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops; ground and polished to match top.

H. Hose Bibb: T & S Model No. B-0674-BSTP; mounted on 12 gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel hose hanger.

I. Scrapping Trough in soiled dishtable: 14 gauge stainless steel with all corners coved, integrally welded to dishtable. Slope 8" wide trough from 4" depth to Salvajor Troughveyor, pulper, integral disposer or pre-wash sink. Form long sides of trough on 60° angle with ½" x ½" recessed shoulder at juncture of dishtable and furnish one 8" x 20" 16 gauge stainless steel sliding/removable pan-formed perforated (½" holes punched 1½" o.c.) trough cover per each 3' of trough.

J. Disposer Sink: 18" x 18" x 7½" 14 gauge stainless steel with all interior corners coved, integrally welded to dishtable/scrapping trough fitted with removable silver-trap(s). Removable flush cover: 16 gauge stainless steel ½" pan-formed and perforated (½" holes punched 1½" o.c.) with welded corners and finger ring. Support clips: ¼" stainless steel rod 2" long, formed at 45° with two ¾" leg ends (¼" long threaded ends). Insert rod-clips through tight clearance holes in sink, seal watertight and secure with stainless steel acorn-nuts or tack-weld at exterior of sink wall, set support clips for flush cover position (approximately ½" below top).

2.12 DOORS

A. 18 gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal perimeter joint of pans. Offset lower horizontal framing member of Closed Base Body to align flush access door with bottom of Body.

B. Channel-formed full-length horizontal recessed pull: ¾" turndown at front and ends with ½" tight hem. Front edge of pull: flush with face of door. Recess behind pull: sloped up on 60° angle and terminated 1" below bottom edge of pull.

C. Door Hardware:
   1. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).
   2. Component Hardware Model No. 35-2000 concealed Magnetic Catch.

D. Louvered opening: cut-out opening size as indicated, turn in 1" and weld. All corners: ground and polished.
   1. Full-height 18 gauge stainless steel louver with 1" vanes at 45°, ½" spacing. Perimeter channel-formed frame: 1½" x 1". 45° x 1" x ½" x opening width plus ½" 18 gauge stainless steel louver.
2. Tack weld tab of louver flange to back panel of door.

E. Sliding Doors: fabricate same as Paragraph "A."
   1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required. Secure to angle frame at top of underside.
   2. Front/rear door sheaves: stainless steel ¾" side mounted door hangers; two (2) required per door.
   5. Door Stop at bottom edge of door: Component Hardware Model No. B60-1086.

F. Offset lower horizontal framing member of Closed Base Body/utility compressor compartment to align door flush with bottom of Body.

2.13 CLOSED BASE BODIES

A. Frame: frameless construction utilizing formed front, end and intermediate panels of 16 gauge stainless steel. Upper, intermediate and lower horizontal framing members of 16 gauge stainless steel. Top opening to have front to back stiffeners at 24" o.c. maximum.

B. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: closed and sealed

C. Closed Base Bodies set on finished masonry platforms: closed and caulked at underside of equipment overhang and bolted to platform. Body overhang of platform: 1" at free ends 2" at front and exposed rear sides.

D. Closed Base Bodies not set on platform: Component Hardware Model No. A48-5048-C, 6" legs spaced 5'-0" o.c. maximum.

2.14 COMPRSSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.

B. 10 gauge steel slide out support: channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on solid platform: front-to-back slide out support channels set 4" above bottom for air circulation.

C. Access Door: 18 gauge stainless steel double-pan type with channel formed horizontal recessed pull full length of top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turn down at front and face of door. Recess behind pull slopes up on 60° angle, terminating 1" below bottom edge of pull. Offset lower horizontal framing member of Closed Base Body to align flush access door with bottom of body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

2.15 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18 gauge stainless steel double-pan type with channel formed horizontal recessed pull full-length of top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turn down at front of door, recess behind pull slopes up on 60° angle, terminating 1" below bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of door with face and bottom edge of body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.

D. No shelves of Closed Base Fixtures are to be penetrated.
2.16 UTENSIL RACKS
   A. Rack: ¼" x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match shape shown on drawings. Lowest band: 90" aff, unless otherwise indicated.
   B. Table Mount Supports: 1-5/8" diameter 16 gauge stainless steel tubing extended thru counter top. Secure to closed base framing or crossrail/undershelf on open base fixture. Tubing penetrations of counter tops: integrally welded stainless steel inverted gusset.

2.17 PLASTIC LAMINATED FIXTURES
   A. Body Panels: ¾" thick marine grade hardwood plywood with plastic laminate in Architect's selection of color/pattern on all exposed surfaces; backing sheet where concealed, including edges.
   B. Exterior front or end panels secured to body in concealed manner, as detailed or specified.
   C. Interior shelves and vertical partitions of back counters, service stand and condiment counters: same material as body panels, veneered on all exposed surfaces with plastic laminate, backing sheet where concealed.
   D. Plastic Laminate Fixture: all joints, seams, blocking, etc. in accordance with AWI "custom" grade standards.
   E. Concealed Hardware: Grass Model No. 1200VZ or 1200VZ8 self-closing hinges, three required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM-820 concealed push latch at each door. Confirm Model numbers and provide samples with submittals.
   F. Plastic Laminated Fixture installed on finished masonry platforms: closed and caulked at underside of overhang and anchored to platforms: unless shown otherwise, fixtures shall overhang the platform 1" at free ends, 2" at front and exposed rear sides.
   G. Plastic Laminated Fixtures not set on platforms: 4" high integral toe-base constructed same as body, finished as directed. When specified to be mobile: casters with integral skirt at perimeter of base, finished as directed.

2.18 CASHIER / SERVING COUNTERS
   A. Exterior Body Panels: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.
   B. Position, size and finish horizontal or vertical reveal as directed by Architect.
   C. Secure panels to counter body framing in concealed manner. Install removable panels with “Z” clips overlapping body framing members.
   D. Rear side and interior of serving counters: "Closed Base Bodies." Vertical juncture of plastic laminate/solid polymer and stainless steel panels at rear corners of body: ½" wrap-around of stainless steel set in routed recess for flush joint with plastic laminate or solid polymer.
   E. Hinged doors in exterior body panel(s): Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three (3) required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with submittal.

2.19 OPEN BASE STRUCTURES
   A. 1-5/8" o.d. x 16 gauge seamless stainless steel tubing legs beveled at bottom. 1-5/8" o.d. crossrails fully-welded (360° smooth and polished) to legs at 10" aff, o.c.
   B. Top of Leg: inserted in Component Hardware Model No. A20-0206-C gusset fully-welded to table frame or sink bottom.
   C. Bullet Foot: Component Hardware Model No. A10-0851-C.
   D. Table Bases: maximum leg spacing of 6'-0" o.c.; dishtable and utensil wash counter bases at 5'-0" o.c.
2.20 UNDERSHELVES

A. Open Base Structures: 16 gauge stainless steel turned down 1½" with ¾" tight hem at bottom. Notch all corners to fit tubular legs and weld from underside to completely fill gap; grind and polish. Cove up 2" with ¾" tight hem at rear or ends adjacent to wall, columns, refrigerators, etc. The turn up at freestanding fixtures is to be hemmed tight to bottom of turndown. Brace undershelf with 1" x 4" x 1" 14 gauge stainless steel channel at longitudinal centerline and at each intermediate pair of legs.

B. Closed Base Fixtures: 16 gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.
   1. Shelves: turn up square at ends (coved up at rear only) to the shelf above or counter top flanged out for attachment with no open spaces at interior.
   2. All shelf partitions at exposed ends of cabinet bodies or interiors: free of exposed framing members.
   3. Reinforce shelves with full-length 1" x 4" x 14 gauge stainless steel closed hat channel.
   4. Unless otherwise noted, all closed base undershelves are to be 22" deep, clear.
   5. Fully weld smooth and polish, the vertical seam of shelf turndown/turn up with face of body partition.
   6. Seal the vertical seam of square turn-in at exposed interior of open shelf sections.

2.21 ANCHOR PLATES/WOOD GROUNDS

A. Behind finish surface wherever building wall, partitions or ceiling construction will not accommodate direct attachment of equipment such as overshelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 114000.

B. Anchor Plates: not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: length required by fixture, component or device, 24" wide x ¾" thick plywood secured to partition system prior to gypsum board installation.

D. Above ceiling supports: structural shapes (4" x 8.0 lb. channel) suspended from structure. Maximum height 15'-0" aff. size: width of equipment x length of equipment plus 6'-0". Crossbracing at 6'-0" on center maximum.

2.22 OVERSHELVES

A. 16 gauge stainless steel with free edges turned down 1" with ½" tight hem at bottom. ¾" radius at free corners.

B. Turn up 2" raw at walls or adjoining high fixtures with horizontal coved corner at rear. Round front corners of turn up on ¾" radius.

C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14 gauge stainless steel closed hat channel full-length of shelf.

D. Wall-Mounted Shelves: 16 gauge stainless steel brackets 48" o.c. maximum, set in 6" from ends.

E. Freestanding Shelves: where splash is required at free overshelves, turn up square 2" at ends, cove up at rear and hem tight to lower edge of front turndown. Weld exposed corners.
   1. Freestanding overshelves: 16 gauge stainless steel cantilevered brackets at rear of table; double-cantilevered brackets at center of table. Posts for cantilevered overshelves are 1-5/8" o.d. x 16 gauge stainless steel secured to underframe, 4'-0" o.c. Ends of shelves: secured to adjacent wall/fixture or mounted on 1½" diameter stainless steel posts.
   2. Freestanding overshelves not on cantilevered brackets: 1½" o.d. x 16 gauge stainless steel posts, each pair at 4'-0" o.c., maximum.

F. Glass/Cup Rack Overshelf at Dishtables: 14 gauge stainless steel with 1½" deep "vee" trough at free long sides with 1" tight hem at inside of trough. Provide a ½" marine edge at free ends; 4" splash at wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" o.d. stainless steel tubing supports from structure above ceiling at front edge, 60" o.c./each end.
   1. Install at both ends, ½" stainless steel drain-tube (connecting both vee-troughs) extended to dishtable surface through splash turnback.
2. Rack-rest: horizontal full-length 1-5/8" o.d. stainless steel tubing supported at 10" o.c. above shelf (8" o.c. for double service shelf) by 1¼" o.d. stainless steel tubing with closed ends. Support tubing: welded, ground and polished, spaced 60" o.c.
3. Rack-rest supports to wall: 4" x 4" x 10 gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.23 WALL PANELS
A. Wall Panels: 18 gauge stainless steel, double pan-formed ½" thick with internal stiffener members. Fill with USDA approved thermal insulation, full height and width of panels, attach to interior with mastic. Maximum allowable temperature at rear side of panel: 120°F.
   1. Height of panels as required: top of tile base to underside of hood, top of tile base to top cap of stub wall or top of splash to underside of hood.
   2. Level and square lower edge and sides.
   3. Butt joint all panels.

2.24 EXHAUST HOOD FIRE EXTINGUISHING SYSTEM (Fusible-Link / Liquid Chemical)
   A. System: installed in accordance with manufacturer's recommendations and applicable codes or standards. Submit Installation certification Form to Architect.
   B. Automatic Chemical System: in each filtered exhaust hood/duct assembly and also surface protection above/in all equipment required by NFPA Bulletin No. 96 and local Fire Marshall's regulations. Refer to Contract Drawings for quantity of exhaust fan units serving single or multiple exhaust hoods and coordinate with hood/fan controls.
   C. Install chemical cylinders as indicated on drawings and install piping to exhaust hoods in totally-concealed manner. Set cylinders and cabinets at underside of finished ceiling unless noted otherwise. Exposed piping/fittings within cylinder location and exhaust hood: chrome-plated or sleeved with stainless steel tubing. Exposed pipe threads in/above food zone not acceptable. Submit schematic diagram of installation and confirm critical distances from cylinders to nozzles.
   D. System Components: Ansul R-102 system assemblies, in system increments required by dimensions and configuration of equipment and hoods.
   E. Remote Manual Release: located in path of egress from protected exhaust hood area. Division 26 to provide 4" Octagon box in wall (at 48" aff) with EMT conduit stub to 6" above finished ceiling.
   F. Each System: Ansul Automan cylinder control assembly with electric switch.
   G. Fusible links installed in duct collar of filtered hoods/ducts.
   H. Fusible links located directly above each cooking device required by Code, in quantity required by length of protected appliance.
   I. Ansul K-Guard series. fire extinguisher located at each exhaust hood. Install at 36" aff to bottom of extinguisher.
   J. Required quantity and sizes of mechanically-operated gas valves.

2.25 HIGHLIGHTING
A. Polish the following vertical surfaces to a No. 8 finish:
   1. Stainless steel table and counter top turndowns and backsplash returns.
   2. Dishtable and utensil wash counter rolled rims (full radius).
   3. Overshelf turndowns.
   4. Door and drawer horizontal pulls.
   5. Conveyor and dish/tray deposit station turndowns/frame.

2.26 SHOP/FIELD JOINTS
A. Field joints: least possible number, used only when equipment size must be limited for access into building or interior space.
B. Stainless steel tops (including edges and splashes): fully welded, ground and polished to match adjacent surface.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw-joints: located and noted on shop drawings.

D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide flat backing surface for joint with angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" o.c.

E. Closed Base Bodies: draw-type with hairline seam fully field-welded.

F. Millwork: plastic laminated material joints shall be doweled, glued and draw-bolted with fasteners.

G. Solid Polymer: surfaces drawn tight, filled, sanded and finished to match adjacent surface.

2.27 PREFABRICATED COLD STORAGE ASSEMBLIES

A. Sectional Assemblies: size/shape indicated on drawings; 8'-6" aff unless otherwise specified. Door locations/size: exactly as shown.

B. Sandwich Panel Insulation: Class 1 Urethane with vapor barrier, 4" thickness with mature "U" factor of .030 or lower.

C. Panel Skin Material/Finish: Embossed stainless steel exposed exterior panel surfaces, 22-gauge galvanized concealed panel surfaces. Interior walls embossed aluminum with baked-on primer and finish application of white polyester enamel.

D. Interior Ceiling Panels: 20 gauge zinc coated steel with baked-on primer and finish application of white polyester enamel.

E. Wherever compartment dimension exceeds clear-span ability of ceiling panels, provide I-beam support on exterior of ceiling or spline-hangers. Install ½" diameter steel rods through beam/hangers and secure to structure above. Beams or posts within compartments are not acceptable.

F. Reinforce prefabricated wall panels to rigid-support the door assemblies. All door jambs: furnished with replaceable full-perimeter thermostatically-controlled heater cable. Install 2" x 4" 16 gauge stainless steel hat-channel full-width of jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

G. Integral Floor Panels:
   1. Sandwich panels, same as walls/ceiling except with 14 gauge galvanized skin, sealed watertight.
   2. Field-apply 3/16" thick hard-alloy aluminum tread plate No. 6061-T6 with all joints caulked.
   3. Factory-installed ¾" marine-grade plywood sub-floor below the metal skin with all surfaces sealed watertight and all joints/seams caulked.
   4. Treat exterior panel surfaces for concrete exposure.
   5. Sloping interior floor ramp at exterior entrance doors.

NOTE: CONCRETE FLOORING OVER INSULATION PROVIDED BY DIVISION 03/09 AS PER ARTICLE 1.04A THIS WORK IS NOT IN THE SCOPE OF EQUIPMENT SUPPLIER.

H. Each Compartment: 2 ½" diameter chrome-plated flush-mounted dial thermometer with re-calibration. All thermometers furnished with sufficient length of capillary tubing to extend from exterior front of the assembly to a mounting position of the sensor bulb and glycerin container within evaporator return air-stream with tubing clipped to panel at 36° o.c.

I. Each compartment: flush mounted audio/visual high/low temperature alarm panel. Secure alarm control sensor to wall panel in evaporator return air stream.

J. Refrigerant Loss Alarm System – provide per Uniform Mechanical Code 1997 – Section 1120. When required sensors provided in each compartment. Alarm requirements to be calculated by total charge and type of refrigerant for each compartment, figured on a cubic foot capacity.
K. Panic-alarm Switch: installed in each compartment at 72” aff. Interconnect Hubbell "Pressswitch" to audio/visual alarm.

L. Kason Series 1810 LED surface-mounted light fixture.

M. Light Fixtures: wired to interior and exterior companion 3-way Hubbell Pressswitch per compartment, mounted in "FS" boxes with Hypalon covers and pilot lights. Compartments with multiple entrances: 4-way switches.

N. Penetrations of Panels: sealed with Dow Corning 3-6548 silicone RTV foam, full-depth of panel. Trim excess flush.

O. 6" x 1" engraved phenolic-plastic compartment identification sign in Architect's selection of color with 1/2" letters, mounted below respective alarm and thermometer (multiple compartment assemblies).

P. Install closure panels and/or trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.

Q. Compartment Entrance Doors: 36" x 78" nominal clearance unless otherwise noted.
   1. Mount hinged doors on three ball-bearing cam-lift hinges.
   2. Swing doors as indicated on drawings.
   3. Defrost heater: thermostatically controlled and replaceable at full-perimeter of all doors, except when using clear Lexan doors (in addition to door jambs). Defrost heaters to be wired for continuous service.
   4. 30” x 12” 16 gauge stainless steel kick plates at front and rear of all hinged doors.
   5. 12” x 2” engraved phenolic plastic compartment identification sign in Architect's color selection with 1” letters, mounted above door window.
   6. 14” x 22” three-panel glass view window with heater and molded non-metallic inner and outer frame. Heater to be wired for continuous service.
   7. Padlock/key provisions in door latch with interior safety release.
   8. Refrigerator/Freezer Entrance Door Material/Finish: Stainless steel interior/ exterior unless noted otherwise.
   9. Freezer fan switch connected to solenoid (for compressor pump down cycle) at each freezer entrance door jamb, pre-wired thru-wall to top-mounted junction box and freezer evaporator fans with temperature activated override control.
   10. Heated pressure relief ports in freezers to be wired for continuous service.
   11. Full height x width of opening - strip curtain at all exterior doors.

2.28 COLD STORAGE REFRIGERATION SYSTEMS

A. Unit Coolers: specified quantity and model, ceiling-hung by ½” o.d. nylon bolts with stainless steel washers and nuts. Insert hanger bolts through plastic sleeve and seal penetration airtight.
   1. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drainpan outlet with union and cleanout plug and extension of 1” Type K copper drain line through wall panel to air-gap fitting or floor drain under this Section.
   2. Slope drain line ½” per foot, trap at exterior of assembly and turn down into drain. Manifold drain lines of adjacent compartments wherever possible.
   3. Install drain line plastic sleeve through compartment wall, seal around drain line and install stainless steel escutcheon with setscrews.
   4. Electric drain line heater cable: on all unit coolers operating below 36°F., installed from coil drain line fitting to wall penetration under this Section. Heater cables: minimum rating of 30 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2” loop spacing and interwire to unit cooler for continuous operation.
   5. Mounted, pre-piped and pre-wired evaporator components:
      a. Sporlan thermostatic expansion valve with external equalizer.
      b. Shut-off valve at evaporator suction and liquid lines.
      c. Sporlan "Catch-All" refrigerant filter/dehydrator on liquid line.
      d. White Rogers 1609-101 adjustable thermostat with remote bulb positioned in return air-stream of evaporator.
      f. Electrical disconnect switch in NEMA 4 enclosure.

B. Multi-circuited Condenser: RDT, air-cooled pre-wired control panel and:
   1. Suction and discharge line vibration eliminators.
   2. Shut-off valve at condensing unit inlet and outlet.
   3. Suction line filter/dryer.
4. Oil separator for all compressors that are:
a. Positioned 20'-0" higher than the coil.
5. Condensing units installed in an area subject to weather conditions or low ambient temperatures:
   furnished with a stainless steel enclosure; cold weather controls package.
6. 12" x 2" engraved phenolic plastic condenser identification signs in Architects selection of color with
   1" letters mounted on rack below each compressor unit.

C. Refrigerant System Installation.
   1. Refrigerant Lines; Type "L" hard copper tubing. Fittings: wrought copper or brass designed for use
      with high temperature solder. Piping joints: made with silver solder (Sil-Fos). Piping: properly
      suspended from and anchored to the structure with adjustable hangers 6" o.c. maximum. Suction
      lines: sized to have maximum pressure drop of two pounds in medium temperature systems; one
      pound in low temperature system. Liquid lines: sized to give maximum pressure to prevent trapping
      of oil. Insulation on all suction lines: Armaflex insulation by Armstrong. ¾" thick at medium temp
      1" thick at low-temp. Refrigerant lines in PVC or EMT conduit: sealed at both ends with Dow Corning
      3-6548 silicone RTV foam. Exterior Refrigerant Lines to be wrapped by refrigeration system installer
      in self fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum
      strapping and seals for applying aluminum jacket and covers according to manufacturer's
      recommendations to provide completely weather-tight covering.

D. Evacuation and Charging.
   1. After completion of the pressure test, the system shall be evacuated using an approved auxiliary
      vacuum pump. Connections for evacuation: in accordance with manufacturer's recommendations.
   2. Charging subsequent to the initial charge which is contained in the condensing unit (R-404A
      Refrigerant for medium and low temp units, R134A for High temp units): given through the charging
      valve in the high side passing all the liquid refrigerant through a charging dehydrator. All charging
      lines and gauges: purged of air prior to connection with system. Refrigerant: unused and shall be
      delivered in clean containers. After the system is fully charged: start and place in full operation.

2.29 SOURCE INFORMATION

Alkco Manufacturing Company  The Ansel Company
11500 West Melrose Avenue  One Stanton Street
Franklin Park, Illinois 60131  Marinette, Wisconsin 54143
(847) 451-0700  (715) 735-7411
FAX: (847) 451-7512  FAX: (800) 543-9822

Chemgrate Corporation  The Chicago Faucet Company
5151 Beltline Rd., Ste. 1212  2100 South Clearwater Drive
Dallas, Texas 75254  Des Plaines, Illinois 60018 + 5999
(800) 527-4043  (847) 803-5000
FAX: (847) 803-5454

Coldzone Refrigeration  Component Hardware Group, Inc.
1935 Vineyard  1890 Swarthmore Avenue
Ontario, Ca 91761  Lakewood, New Jersey 08701
(909) 786-3656  (732) 363-4700
FAX: (714) 529-8503  FAX: (732) 364-8110

Dormont Manufacturing  Doug Mockett & Company
6015 Enterprise Drive  (Chrome Plated Grommets)
Export, Pennsylvania 15632  P.O. Box 3333
(724) 735-4800  Manhattan Beach, California 90266
FAX: (724) 733-4808  (310) 318-2491
FAX: (310) 376-7650
PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: provide a competent foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: coordinate with progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

1. Field-Assembled Fixed Equipment integrated into the structure (e.g., cold storage assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job-site when directed by the General Contractor and installed/protected accordingly.

2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.
3. Major Movable Equipment: delivered when possible to inventory in secured area for interim job-site storage or, if secured area is not available, when fixed equipment installation/clean-up has been completed.

4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) delivered only when Owner is prepared to receive and inventory such items.

C. Installation: performed by manufacturer of custom fabricated fixtures/equipment contractor.
   1. Assemble, square, level and make ready all items for the final utilities connections.
   2. Cut neatly around obstructions to provide sanitary conditions.
   3. Where gaps of ¼” or less occur adjacent to or between equipment, insert rope backing and smoothly-applied General Electric construction sealant Series SE-1200 silicone mastic. Mask both sides of gap for neat application of sealant and remove excess. If space exceeds ¼”, neatly install 18 gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or “Z” clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.

4. Refrigeration coil drain line runs to indirect drain connection greater than 2” from face of wall or panel: either of the following field procedures.
   a. Trench the floor and provide 6” wide x 2” deep 16 gauge stainless steel sloping (-1” to -2”) trough from face of cooler/freezer wall to body of floor sink/floor drain. Trough: turned up 4” at wall; ¾” flange with ½” turndown at both long sides. Set trough in waterproof mastic and seal 1” o.d. drain tube penetration into floor sink/floor drain at -2½” bff. Patch the floor to match adjacent material/surface.
   b. Provide 12” x 6” x 2” deep 16 gauge stainless steel condensate pan mounted to cooler/freezer wall at 6” aff clear. Trench the floor and install 1” o.d. drain line from bottom of pan to body of floor sink/drain. Slope drain line ¼” per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:
   1. Fabricated fixtures: fiberboard or plywood taped to tops and exposed body panels/components.
   2. Manufactured Equipment: fiberboard or plywood taped as required by equipment shape and installation-access requirements.
   3. Prohibited use of equipment: tool and materials storage, workbench, scaffold, stacking area, etc.
   4. Damaged Equipment: immediately documented and submitted to Owner with Contractor’s recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove from the job site, all debris resulting from this Work as the installation progresses.

B. Thoroughly clean and polish interior/exterior of all Foodservice Equipment, prior to demonstration and final observation, ready for Owner’s use.

C. Lubricate and adjust drawer slides, hinges, casters.

D. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

E. Clean or replace faucet aerators, line strainers.

F. Touch-up damage to painted finishes.

G. Start up and check operation of all refrigeration systems for at least 72 hours prior to acceptance.

3.3 EQUIPMENT START-UP/Demonstration

A. Carefully test, adjust and regulate all equipment in accordance with the manufacturer’s instructions and certify in writing to the Owner that the installation, adjustments and performance are in full compliance.

B. Provide the Owner or Foodservice Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected items of equipment and attendees with Owner at least two weeks in advance of demonstration periods.

3.4 FINAL OBSERVATION
A. Final observation will be made when the Contractor will certify that he has completed his work, made a thorough review of the installation/operation of each item in the contract and found it to be in compliance with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated thereto which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a time and expense basis.

**PART 4 - EQUIPMENT SCHEDULE**

4.1 **REGULARLY-MANUFACTURED EQUIPMENT/COMPONENTS:**
   A. Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 **FABRICATED AND FIELD-ASSEMBLED EQUIPMENT:**
   A. Arrangement and configuration as shown on Plans, Elevations and Detail Drawings.

4.3 **REFER TO DRAWINGS:**
   A. For unit quantities and electrical or mechanical provisions required, including manufacturer’s optional voltages, wattages, burner capacities, etc.

4.4 **REFER TO PART 2 – PRODUCTS:**
   A. For accessories, fittings, requirements and procedures related to the listed buy-out and fabricated equipment.

4.5 **FOODSERVICE EQUIPMENT**

**RETAIL**

**BAKERY/COFFEE/MARKET**

**ITEM 601 - COFFEE/BAKERY SERVING COUNTER**
Manufacturer/Model: Counter Craft
Utilities: Refer to drawings.
Construction: Refer to drawings and Part 2 - Products.

- Top: Solid surface with 2" square edge top turndown at all sides.
- Front/exposed end panels prepared for field – applied cement board and tile finish.
- Closed base body construction.
- Built-in appliances/components as indicated with framing members at perimeter of cut out in top.
- Provide lined counter body recess for Item No. 603 – Under Counter Refrigerator and Item No. 607 – Under Counter Ice Machine W/Bin and Item No. 608 – Bakery Case.
- Provide grommeted openings in top for top mounted equipment.
- Espresso Parts Model EPPR662 Rinser, 6"W x 6"D x 2"H, stainless steel, NSF
- Utility compartment.
- Pre-wired junction boxes located in counter body for all equipment items.
- Two (2) NEMA 5-20R-GFCI, 120 volt, single phase general-purpose outlets mounted below countertop.
- One (1) electrical load center compartment with one Square “D” Model No. Q0312L125G circuit breaker load center with ground bar kit, Visi-Trip breakers and Model No. Q0C16UF cover/door, (rated to 60 amps; 208 volts, three phase; 4 wire; 12 spaces); installed in “Utility Compartment”.
- Install on 6" high stainless steel legs with removable stainless steel kickplate setback 3” from leading edge of exposed counter body.

**Special Instructions:**
- Verify solid surface/finish/color selection with Architect.

WORRELL DESIGN GROUP

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FOODSERVICE EQUIPMENT

**ITEM 602 - ESPRESSO CAPPUCINO MACHINE**
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- (040381-00090EUS) Coffee Art Plus (Touch Screen) Espresso Machine, super-automatic, 70-80 beverages per hour (16 oz.), dual boilers, Finesteam® technology auto foam steam wand, built in auto temperature sensor & automatic shut-off, heats up to 32 oz. (1 liter) per min., tampering & shot dispensing, up to 64 programmable options, touch screen, automatic grinding, dual integrated grinders/hoppers, 5 minute cleaning cycle, drain line required, ANSI / NSF-4, ANSI / NSF-372 and UL-197, ETL-Listed, cETLus.
- 9611998041 Installation 2-Step.
- 9611998042 Startup and Calibration 2-Step.

**ITEM 603 - UNDERCOUNTER REFRIGERATOR, 3-DOOR**
Manufacturer/Model: True Model TUC-72-ADA-HC – Under Counter Refrigerator.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- Undercounter Refrigerator, 34” working height, 33 - 38°F, (3) stainless steel doors, (6) PVC coated adjustable wire shelves, stainless steel top & sides, aluminum interior with stainless steel floor, 3” castors, R290 Hydrocarbon refrigerant, cULus, UL EPH Classified, ADA Compliant, Made in USA.
- Self-contained refrigeration standard.

**ITEM 604 - BACK COUNTER WITH SINK**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Size: Refer to drawings x 2'8” deep x 3'0” high to counter top surface.
Construction:
- Refer to drawings and Part 2 - Products.
- Top: Refer to “Counter/Table Tops Construction” with square edge turndown at all free sides, 6” splash at rear.
- Closed base construction.
- One (1) 16” x 20” x 10” deep utility sink with T & S Model No. B-0301 gooseneck faucet with E3 Soft-flo aerator.
- Hand Lavatory:
  - 01 One (1) 12” x14” x 8” deep sink.
  - 02 One (1) T & S Model No. B-1110-QT deck mount faucet with 6” swing Nozzle, B-PT Stream Regulator.
- Hinged doors, One (1) louvered, at Item No. 610 – Drop-In Freezer.
- Utility compartment at sink.
- Storage compartment.
- Ambient bread display shelves by Division 06 – Millwork.
- Grommeted opening in top for top mounted equipment.
- Bottom and intermediate undershelf, refer to “Undershelves”.
- Built-in appliances/components as indicated with framing members at perimeter of cut out in top.
- Lined counter body recess for one (1) Item No. 603 – Under Counter Refrigerator, one (1) Item No. 622 – Under Counter Heated Cabinet.
- Install on 6” high stainless steel legs with removable stainless steel kickplate setback 3” from leading edge of exposed counter body.

**ITEM 605 - SOUP KETTLE WARMER**
Manufacturer/Model: Avantco Model 177S30SS – Soup Kettle Warmer.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- 11-qt round stainless steel countertop food/soup kettle warmer. Includes hinged lid, ring, 11-qt stainless steel inset, and 14 popular soup and stew labels.
ITEM 606 - COFFEE BREWER
Vendor Furnished/Vendor Installed
Special Instructions:
• This Item is Vendor Furnished/Vendor Installed. Not Included in Section 114000 – Foodservice Equipment Contract.

ITEM 607 - UNDER COUNTER ICE MAKER W/ BIN, CUBE-STYLE
Manufacturer/Model: Hoshizaki Model IM-200BAC – Ice Maker W/ Bin, Cube-Style.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
• Undercounter Ice Maker, Cube-Style, 39-1/2"W, air-cooled, self-contained condenser, production capacity up to 188 lb/24 hours at 70°/50° (150 lb AHRI certified at 90°/70°), 75 lb built-in storage capacity, stainless steel finish, individual square cube style, Evercheck™ digital control with LED display, alert system, removable filter, R404 refrigerant, NSF, cETLus, UL.
• Model H9320-51 Water Filtration System, single configuration, 18.4" H (manifold & cartridge).
Special Instructions:
• Provide with 1" adjustable feet.

ITEM 608 – BAKERY CASE
Manufacturer/Model: Structural Concepts Model NE7220RSV – Bakery Case.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
• Model NE7220RSV Reveal® Service Refrigerated Slide In Counter Case, 71-3/4"W, 20-3/8"H (above counter) 39-5/8"H (overall), Breeze-E (Type II) with EnergyWise self-contained refrigeration, (1) removable & adjustable clear glass shelving, LED top & shelf lights, vertical, fixed front & side uv frameless glass, slide in base, glass ends, clear glass rear sliding doors, blue fin coated coil, condensate pan, black exterior & interior, cETLus, ETL-Sanitation
• NOTE: If GFCI is required, a GFCI breaker MUST be used in lieu of a GFCI receptacle
• 1 yr. parts & labor warranty, 5 yr. compressor warranty, standard
• Model HEIGHTNOTE1 Minimum of 19-1/4" space required beneath counter surface
• Breeze-E (Type II) with EnergyWise self-contained refrigeration rear access, (see important notes) standard
• 110-120v/60/1-ph, 9.86 amps, standard
• 6 ft Straight blade power cord (self-contained), NEMA 5-15P, standard
• Interior: Black, standard
• Exterior: Black, standard
• Left end glass: Glass end, standard
• Right end glass: Glass end, standard
• Rear door: Reflective Glass rear sliding doors
• Lights: LED 3000K with frost lens
• Rear vented panel: None, standard
Special Instructions:
• Verify plastic laminate material color/pattern selection with Architect.

ITEM 609 - MOVABLE IMPULSE SHELVES
Special Instructions:
• This Item is by Millwork – Division 06. Not Included in Section 114000 – Foodservice Equipment Contract.

ITEM 610 – DROP-IN FREEZER
Manufacturer/Model: Perlick Model 8000B – Drop-In Freezer.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
• Ice Cream Freezer, drop-in, 3-gallon capacity, stainless steel top & removable hinged door lid, R290 Hydrocarbon refrigerant, 1/6 HP, cULus, NSF.

ITEM 611 - TRASH CONTAINER
Manufacturer/Model: Rubbermaid Model FG354060GRAY Slim Jim Trash Container.
Unit Size: Refer to Drawings
Equipment:
- Slim Jim® Container, 23 gallon, 22"W x 11"D x 30"H, with venting channels, molded-in handles, general purpose waste, open type without lid, high-impact plastic construction, gray, Made in USA

ITEM 612 - REACH-IN REFRIGERATOR
Manufacturer/Model: True Manufacturing Co., Inc. Model STA1R-1S-HC – Reach-In Refrigerator.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- SPEC SERIES® Refrigerator, reach-in, one-section, (1) stainless steel door with lock, cam-lift hinges, digital temperature control, (3) chrome shelves, LED interior lights, stainless steel front & sides, aluminum interior sides & walls, stainless floor & ceiling, 5" castors, R290 Hydrocarbon refrigerant, 1/4 HP, 115v/60/1-ph, 3.8 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®.
- Field reversible door.
- (3) chrome shelves and shelf supports standard per section.
- 5" castors, set of 4, standard.

ITEM 613 - REACH-IN FREEZER - GLASS DOOR
Manufacturer/Model: Hillphoenix Model VNRZ-SFC 4’ – Reach-In Freezer – Glass Door.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- Low temperature Glass Door Reach-In merchandiser for frozen foods.
- 5" baseframe. Custom color flat front panel. 1" black bumper.
- Custom color, metal-louvered kick plates, Square end panels with black PVC trim.
- Black interior with black polymer deck pans.
- Black flat bottom wire rack with 3" lip and black PVC PTM.
- (5) Rows 24"x30" matte black solid shelves with black PVC PTM.
- Black Anthony 101LE door frames w/Optimax Pro high-output 4000K LEDs, LH swing.
- Black Anthony ELMD doors with short handles, LH swing.
- Customer-provided light controls and A/C control.
- TXV balance port sweat.
- Heat exchanger.
- Refrigeration lines piped to the bottom.
- Hand valve.
- EBM high-efficiency fan motors.
- Electric defrost 1-phase.
- Electronic defrost/fan control wired to bottom.
- Conforms to UL Standard 471, NSF Standard 7 and CAN/CSA C22.2.
Special Instructions:
- Verify plastic laminate material color/pattern selection with Architect.

ITEM 614 - REACH-IN REFRIGERATOR – FRAMELESS GLASS DOOR
Manufacturer/Model: Hillphoenix Model VRB-VNRB 8’ – Reach-In Refrigerator – Glass Door.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- Medium temperature merchandiser.
- 75” tall, frameless door, coupled with 8” ultra-low front, maximizes product visibility and merchandising versatility.
- 66” interior front facings enhance planogram design options with added flexibility and versatility. With no restrictions in the interior due to refrigeration components being located in the tank below the deck pan, planograms are easier to design allowing for product to take center stage.
- Bottom-located refrigeration components facilitate serviceability and allow for full top shelf merchandising.
- Modular interior components design allows easy access to the coil, fans and drain for ease of maintenance.
- Proprietary Synergy-E® technology and energy efficient fan motors ensure uniform case performance and lower average product temperatures with optimum energy efficiency.
- Medium and low temp models match for consistent in-store design.
• Innovative Anthony® Optimax LED lighting choices increase visual impact of product while reducing energy consumption.
• Shelving: VRB - 27", VNRB - 24".
• Removable casters for easy merchandiser unloading and movement during installation.

Special Instructions:
• Verify plastic laminate material color/pattern selection with Architect.

**ITEM 615 - IMPULSE ISLAND MERCHANDISER**

**Millwork – Division 06**

Special Instructions:
• This Item is by Millwork – Division 06. Not Included in Section 114000 – Foodservice Equipment Contract.

**ITEM 616 - MERCHANDISE SHELVING W/CABINET BASE**

**Owner Furnished/Owner Installed**

Special Instructions:
• This Item is Owner Furnished/Owner Installed. Not Included in Section 114000 – Foodservice Equipment Contract.

**ITEM 617 - CASHIER COUNTER**

**Millwork – Division 06**

Special Instructions:
• This Item is by Millwork – Division 06. Not Included in Section 114000 – Foodservice Equipment Contract.

**ITEM 618 - CASHIER COUNTER**

**Millwork – Division 06**

Special Instructions:
• This Item is by Millwork – Division 06. Not Included in Section 114000 – Foodservice Equipment Contract.

**ITEM 619 - P.O.S. SYSTEM**

**Owner Furnished/Owner Installed**

Special Instructions:
• This Item is Owner Furnished/Owner Installed. Not Included in Section 114000 – Foodservice Equipment Contract.

**ITEM 620 – DIPPER WELL**

Manufacturer/Model: T&S Model B-2282-01.

Equipment:
• Model B-2282-01 Dipper Well Faucet, 5/16" ID for sweat fitting or remove coupling 1/2" NPSM male shank, 1-1/2" brass tube, drain, polish chrome-plated solid brass knob, stainless steel bowl & inner overflow cup

Special Instructions:
• Install into Item No. 708 – Shake Station Top.
• Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 621 – TURBO CHEF**

Manufacturer/Model: TurboChef Model SOTA – Rapid Cook Oven.

Unit Size: Refer to Drawings
Utilities: Refer to Drawings

Equipment:
• Sota™ Convection/Microwave Oven, Rapid Cook, electric, 16" wide, ventless, countertop, insulated cook chamber, stores up to 256 recipes, internal catalytic converter, LED timer, pull down door with ergonomic handle, multi-speed convection blower, removable rack and bottom jetplate, smart voltage sensor technology (US only), includes (2) solid aluminum pan, (1) oven cleaner, (1) oven guard, (1) aluminum paddle, (2) trigger sprayers, (1) standard rack, stainless steel interior, powder coated, corrosion-resistant steel outer wrap and door, 4" legs, cULus, CE, UL EPH Classified, ANSI/NSF 4, TUV.

**ITEM 622 – UNDER COUNTER HEATED CABINET**

Manufacturer/Model: Hatco Model FSHC-6W1 – Under Counter Heated Cabinet.

Unit Size: Refer to Drawings
Utilities: Refer to Drawings

Equipment:
• Flav-R-Savor® Holding Cabinet, Mobile Heated, thermostatically-controlled heat, electrical components, water reservoir, insulated, (1) door, digital temperature readout, adjustable humidity & temperature, (6) adjustable
removable slides for 18“ x 26” or 12“ x 20” pans, slides on 1-1/2“ centers, large swivel casters with wheel locks, NSF, cULus, Made in USA.
- Model SILVER Silver gray side panels.
- Model SILVER Silver gray top.
- 6W1-LPCAST 2“ low profile locking casters in lieu of standard casters.

ITEM 623 - FREESTYLE SODA DISPENSER  Vendor Furnished/Vendor Installed
Special Instructions:
- This Item is Vendor Furnished/Vendor Installed. Not Included in Section 114000 – Foodservice Equipment Contract.

ITEM 624 - ICE MAKER
Manufacturer/Model: Follett LLC Model HCC1410AHS – Ice Maker.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings
Equipment:
- Horizon Elite™ Chewblet® Ice Machine, with RIDE® remote ice delivery equipment, air-cooled, self-contained condenser, for automatically filling countertop ice and beverage dispensers, up to 1450 lb production of Chewblet® ice in 24 hours, no stainless steel top kit required, NSF, cETLus.
- Model 00978957 High Capacity Water Filter System (one per ice machine) for use with all Follett ice machines and ice and water dispensers, filtration capacity 15,000 gallons (56,781 liters), NSF.
Special Instructions:
- Set on top of Item No. 623 – Freestyle Soda Dispenser.

ITEM 625 - CONDIMENT DISPENSER
Manufacturer/Model: Dispense-Rite Model NLS-1.
Equipment:
- Lid, Straw & Condiment Organizer, narrow, 11-3/8"H x 8-1/2"W x 22-7/8"D, stainless steel construction, ABS top organizer.

ITEM 626 - SODA SYSTEM  Vendor Furnished/Vendor Installed
Special Instructions:
- This Item is Vendor Furnished/Vendor Installed. Not Included in Section 114000 – Foodservice Equipment Contract.

ITEM 627 - BEVERAGE COUNTER
Manufacturer/Model: Counter Craft.
Unit Size: Refer to Drawings
Utilities: Refer to Drawings x 2’-10” high to countertop surface.
Construction: Refer to drawings and Part 2 – Products.
- Top: Solid surface with 2” square edge top turndown at front and free sides, 4” splash at wall.
- Plastic laminate covered counter front/panels set into hinged stainless steel pan doors with sturdy hinges.
- Closed body base construction.
- Grommeted opening in countertop for top mounted equipment.
- Utility compartment without bottom shelf, for remote soda system, filters, and CO2 tank.
- Stainless steel kickplate setback 3” from leading edge of exposed counter body at front, attached to backside of hinged doors.
- Install on 6” high stainless steel legs.
Special Instructions:
- Verify solid surface/plastic laminate product finish/color selection with Architect.

ITEM 628 - SELF-ORDER STATION  Owner Furnished/Owner Installed
Special Instructions:
- This Item is Owner Furnished/Owner Installed. Not Included in Section 114000 – Foodservice Equipment Contract.
ITEM 629 - CUP DISPENSER
Manufacturer/Model: Dispense-Rite Model CTC-R-3SS – Cup Dispenser.
Equipment:
- Cup Dispensing Cabinet, adjustable, (3) ADJ-2F, holds 8 oz. to 44 oz. cups, rim dia. 3" - 4-5/8", stainless steel cabinet housing and front plate, 24-1/2"H x 8-1/8"W x 23"D, NSF cup dispensers.
- Verify cup rim diameter prior to ordering.

ITEM 630 – COFFEE AIR POTS
Vendor Furnished/Vendor Installed
Special Instructions:
- This Item is Vendor Furnished/Vendor Installed. Not Included in Section 114000 – Foodservice Equipment Contract.

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ITEM 700 - REFRIGERATION SYSTEM
Manufacturer/Model: Nor-Lake, air-cooled refrigeration system.
Utilities: Refer to drawings.
Equipment:
- Refer to drawings and Part 2 - Products, "Cold Storage Refrigeration Systems".
- Item No. 701 – Meat Cooler:
  One (1) Nor-Lake coil; adjust to +36°F.
- One (1) Nor-Lake air-cooled condensing unit.
- Item No. 701 - Walk-In Freezer:
  One (1) Nor-Lake coil; adjust to -10°F.
- One (1) Nor-Lake air-cooled condensing unit.
Special Instructions:
- Mount condensing units on Nor-Lake air-cooled rack. Rack located outdoors on roof.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

ITEM 701 - COLD STORAGE ASSEMBLY
Manufacturer/Model: Nor-Lake - Cold Storage Assembly.
Utilities: Refer to drawings.
Unit Sizes: Size/configuration as shown on drawings x 8’-6” aff to top of compartment.
Equipment:
- Refer to drawings. and Part 2 - Products, "Prefabricated Cold Storage Assemblies".
- Compartments:
  Refrigerator: One (1) light fixture.
  Freezer: One (1) light fixture.
- Refrigerator: “Floorless” – Install direct to concrete slab.
- Freezer: Step-up integral insulated floor with aluminum tread plate deck reinforced with ¾” marine grade plywood.
- Top closure panel as required, Refer to drawings and “Prefabricated Cold Storage Assemblies”.

ITEM 702 - COLD STORAGE SHELVING
Manufacturer/Model: Metro Metromax Q – Cold Storage Shelving.
Equipment:
- Shelf material/type: Metromax Q/Wire.
- Post material/size: Metromax Q/74".
- Complete shelf assemblies indicated for – Refrigerator:
  Quantity | Size     | Posts
  Two (2)   | 18” x 30” | 4 per assembly
  One (1)   | 18” x 36” | 4 per assembly
  One (1)   | 21” x 42” | 4 per assembly
  One (1)   | 21” x 36” | 4 per assembly
  Complete shelf assemblies indicated for – Freezer:
  Quantity | Size     | Posts
  Three (3) | 21” x 36” | 4 per assembly
  Two (2)   | 21” x 42” | 4 per assembly
- Configuration: 4 tiers, lower shelf adjusted to 8” aff; balance at 14” clear.
- All on casters.

Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 703 - DRY STORAGE SHELVING**

Manufacturer/Model: Metro Metromax Q - Dry Storage Shelving.

Equipment:
- Shelf material/type: Metromax Q / Wire.
- Post material/size: Metromax Q / 86”.
- MetroMax Q™ Shelf, open grid polymer with Microban® antimicrobial product protection, epoxy coat steel frame, (4) wedge connectors, NSF.
- Complete shelf assemblies indicated:
  - Quantity
  - Size
  - Post
  - 24” x 48”
  - 4 per assembly
- Configuration: 5 tiers; lower shelf adjusted to 8” aff, balance evenly spaced.

Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 704 - THREE (3) COMPARTMENT SINK**

Manufacturer/Model: Custom Fabricated.

Utilities:
- Refer to drawings.

Unit Size:
- Refer to drawings x 2’-3” x 2’-10” to counter top surface.

Construction:
- Refer to drawings and Part 2 - Products.
- Top: Raised rolled rim at free sides; 10” high splash at balance.
- Open Base Construction.
- Omit rear cross rail at sink compartment.
- Three (3) 1’-6” x 1’-11” x 15” deep sink compartments.
- One (1) T & S Model No. B-0290 swing faucet for 3/4” hot & cold water connections.
- Full length x 12” deep single overshelv, post mount at 20” above table top. Punch overshelv to accommodate pre-rinse.
- Post mount, full-length utensil rack, extend 1-5/8” stainless steel tubing supports up from back splash through overshelv, turn forward 12” and weld ⅝” x 2’ stainless steel bar at end. Provide Component Hardware No. J77-4401 Double Pointed Hooks at 8” o.c. Top of rack at 84” AFF.
- Undershelf refer to “undershelves”, at right end.
- Install Item No. 724 – Disposer 12” cone and 14-ga. stainless steel control mount.
- One (1) T&S Model B-0133 pre-rinse with wall bracket at left end.

Special Instructions:
- Secure wall mounted equipment/components to in-wall ground or anchor plates, refer to “Anchor Plates/Wood Grounds”.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 705 - WORK TABLE W/ SINK**

Manufacturer/Model: Custom Fabricated.

Utilities:
- Refer to drawings.

Unit Sizes:
- Refer to drawings x 2 ft.-6 in. deep x 3 ft.-0 in. high to table top surface.

Construction:
- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with square edge turndown at free sides, 6” splash at wall.
- Base construction: refer to “Open Base Structure”.
- Omit front crossrail for roll under equipment.
- Omit rear cross rail at sink.
- One (1) 20 in. x 20 in. x 10 in. deep sink, refer to “Sinks”, with removable sink cover.
- Item No. 724 - Disposer installed in counter top.
  - 01 Integrally -welded cone.
  - 02 Punch splash turn back for vacuum breaker.
  - 03 12 gauge stainless steel bracket mounted below counter top, ground and polished to match top for disposer control.

WORRELL DESIGN GROUP
- Full-length 12 in. deep single overshelf post mounted above counter top to clear Item No. 723 - Slicer, refer to “Overshelves”.
- Undershelf, refer to “Undershelves”.

Special Instructions:
- Secure wall mounted equipment/components to in-wall ground or anchor plates, refer to “Anchor Plates/Wood Grounds”.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 706 - WORK TABLE**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2 ft.-6 in. deep x 3 ft.-0 in. high to table top surface.
Construction: Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with square edge turndown at free sides, 6” splash at wall.
- Base construction: refer to “Open Base Structure”.
- Undershelf, refer to “Undershelves”.
- One (1) full-length post mounted single bar utensil rack. Refer to “Utensil Racks”.

Special Instructions:
- Secure wall mounted equipment/components to in-wall ground or anchor plates, refer to “Anchor Plates/Wood Grounds”.
- Notch splash at column.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 707 - BACK CABINET**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Size: Refer to drawings x 2'-8" deep x 3'-0" high to counter top surface.
Construction: Refer to drawings and Part 2 - Products.
- Top: Refer to “Counter/Table Tops Construction” with square edge turndown at all free sides, 6” splash at rear.
- Closed base construction.
- Hinged doors.
- Bottom and intermediate undershelf, refer to “Undershelves”.
- Install on 6” high stainless steel legs with removable stainless steel kickplate setback 3” from leading edge of exposed counter body.

Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 708 - SHAKE STATION COUNTER**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Size: Refer to drawings x 2'-8" deep x 3'-0" high to counter top surface.
Construction: Refer to drawings and Part 2 - Products.
- Top: Refer to “Counter/Table Tops Construction” with square edge turndown at all free sides, 6” splash at rear.
- Closed base construction.
- One (1) 12” x 12” x 10” deep utility sink with T & S Model No. B-0301 gooseneck faucet with E3 Soft-flo aerator.
- Hinged doors.
- Utility compartment at sink.
- Bottom undershelf, refer to “Undershelves”.
- Install on 6” high stainless steel legs with removable stainless steel kickplate setback 3” from leading edge of exposed counter body.
- One (1) full-length zip line set at 6'-2” aff. Left end consists of 14-gauge stainless steel 4” diameter mounting plate with ¼” stainless steel rod formed into “u-shape” as an eye and welded to plate, attached to side wall. At right end, provide 1” square tube post, attached to top right end of table at distance from rear of table to allow zip line to run parallel to wall once left plate is mounted to wall. Provide “u-shape” eye at left-side of post. Provide 50 lb test clear monofilament line attached to each “u-shape” eye with hook and turnbuckle hardware.

Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.
ITEM 709 – NUMBER NOT USED

ITEM 710 - NUMBER NOT USED

ITEM 711 – NUMBER NOT USED

ITEM 712 – NUMBER NOT USED

ITEM 713 – NUMBER NOT USED

ITEM 714 – NUMBER NOT USED

ITEM 715 – 72" REFRIGERATED PREP TABLE

Manufacturer/Model: True Model No. TSSU-72-30M-B-ST-HC

Equipment:
- Model TSSU-72-30M-B-ST-HC Mega Top Sandwich/Salad Unit, (30) 1/6 size (4"D) poly pans, (2) stainless steel insulated covers, 8-7/8"D cutting board, (3) full doors, (6) PVC coated adjustable wire shelves, stainless steel top, front & sides, aluminum back, aluminum interior with stainless steel floor, 5" castors, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 7.2 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA.
- Self-contained refrigeration standard.
- 5" Castors, standard.
- One (1) approximately 18'-6" long zip line set at 6'-2" aff. Left end consists of 14-guage stainless steel 4" diameter mounting plate with ¼" stainless steel rod formed into "u-shape" as an eye and welded to plate, attached to side wall. Attach 1" square tube post with similar "u-shape" eye to side of right-most refrigerator 12" from rear of unit. Provide 50 lb test clear monofilament line attached to each "u-shape" eye with hook and turnbuckle hardware.

Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

ITEM 716 – EXHAUST HOOD

Manufacturer/Model: CaptiveAire Model No. 6030ND-2WI – Exhaust Hood.

Utilities: Refer to drawings.

Unit Size: 5 ft.-0 in. x 5 ft.-0 in. x 2 ft.-6 in. high.

Equipment: Refer to drawings.
- 5'-0" Long Exhaust-Only Island Canopy Hood with Finished Back.
- 100% 304 stainless steel.
- Two (2) Recessed LED Light, 3K warm output.
- FILTER - 20" tall x 16" wide Captrate Solo Baffle Filter with Handles and Bottom Hanging Hook, UL Classified.
- EXHAUST RISER - Factory installed 10" X 4".
- 1/2 Pint Grease Cup New Style, Flanged Slotted.
- FINISHED BACK - ISL/REV INSTALL 60.00" Long.
- DCV-1011 Demand Control Ventilation, w/ control for 1 Exhaust Fan, Exhaust on in Fire, Lights out in Fire, Fans modulate based on duct temperature. INVERTER DUTY 3 PHASE MOTOR REQUIRED FOR USE WITH VFD. Room temperature sensor shipped loose for field installation. Verify distance between VFD and Motor; additional cost could apply if distance exceeds 50 feet. Includes 1 Duct Thermostat kit.
- ESV751N02YX8571 - Variable Frequency Drive - 1 HP Max., 200/240 V, Single or Three Phase Input, 4.2 A Max., NEMA 1 Enclosure, with 2RJ-45 FOR MODBUS.
- 20 wide X18 tall X8.62 deep SS HINGED ELECTRICAL BOX NEMA 1 - VENTED. Includes Fan Filter Assembly.
- USED ON CONTROL PANELS WITH VFD(S).
- CASLink building monitoring system communications module. Requires internet & field wired ethernet connection or 3G cellular service. Includes Rev 3 Comm Module, RJ45 to modbus converter, 3 FT cat5 cable, and 1 FT of shielded twisted pair.
- CAT-5E CABLE - 50 Foot.
- Digital Prewire Lighting Relay Kit. Includes hood lighting relay & terminal blocks. Allows for up to 1400W of lighting each.
- Thermistor CABLE - 18/2 AWG GREEN WHITE, plenum rated. USED for thermistor duct stat.
- CAT-5E CABLE - 50 Foot.

Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.
- Install at 6'-10” aff to bottom of hood.
- Support from structure above ceiling with 1/2” o.d. steel rod.
- Secure wall mounted equipment/components to in-wall ground or anchor plates, refer to “Anchor Plates/wood Grounds”.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 717 – EXHAUST HOOD FIRE PROTECTION SYSTEM**
Manufacturer/Model: Ansul Model R-102 Series System.
Utilities: Refer to drawings.
Equipment:
- Exhaust Hood Fire Suppression System, Refer to drawings. and Part 2 - Products, “Exhaust Hood Fire Extinguishing System”.
- Remote fire pull as indicated on drawings.
- Wall mounted hand held type K extinguisher.
Special Instructions:
- Provide hood/duct protection for Item No. 716 – Exhaust Hood.
- Provide surface protection for cooking equipment.
- Install surface mounted fire protection system at 9'-0” aff.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 718 - CONVEYOR OVEN - STACKED**
Manufacturer/Model: Lincoln Model No. 2500-2
Equipment:
- Model 2500-2 Lincoln Impinger® Countertop Oven Package, electric, double stack, includes (2) ovens with digital controls, extended conveyor and one 4” exit shelf per oven
- Right to Left belt direction.
- (2) 208v/60/1-ph, 6kw, NEMA 6-50P
- Standard motor.
Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 719 - WORK TABLE**
Manufacturer/Model: Custom Fab.
Equipment:
- Mobile stainless steel equipment stand with undershelf for Item No. 721 – Microwave Oven.
- 4” diameter casters; two (2) with brakes.
Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 720 - NUMBER NOT USED**

**ITEM 721 - MICROWAVE OVEN**
Manufacturer/Model: Panasonic Model NE-1054F.
Equipment:
- Model NE-1054F PRO Commercial Microwave Oven, 1000 watts, 0.8 cu. ft. capacity, (6) power levels, 2- & 3-stage cooking, 20 program memory capacity, touch control pad with Braille, 99-minute timer, programmable and manual operation, program list/cycle counter, self diagnostics, tone control, bottom energy feed, interior light, see-through door with "grab & go” handle, stainless steel front, 120v/60/1-ph, 13.4 amps, cord, NEMA 5-15P, cULus, NSF
Special Instructions:
- Install on shelf of Item No. 719 – Work Table.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

**ITEM 722 - FRONT COUNTER**
Millwork – Division 06
Special Instructions:
- This Item is by Millwork – Division 06. Not Included in Section 114000 – Foodservice Equipment Contract.
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.
ITEM 723 - SLICER
Manufacturer/Model: Hobart Model HS9-1
Equipment:
- Heavy Duty Meat Slicer, automatic, 13” CleanCut™ removable knife with removal tool, anodized finish with (6) interlocks, (3) stroke lengths & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, product fence, single action top mounted sharpener with Borazon™ stones, manual lift lever, 1/2 hp motor, 120v/60hz/1-ph NSF cETLus.
Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

ITEM 724 - DISPENSER
Manufacturer/Model: Salvajor Model No. 300-CA-12-MRSSLD – Disposer.
Utilities:
- Refer to drawings.
Equipment:
- Disposer, with 12” cone assembly, 3 Hp motor, start/stop push button manual reversing with safety line disconnect MRSS-LD control, includes fixed nozzle, vacuum breaker, solenoid valve, scrap ring and flow control, heat treated aluminum alloy housing, 6-1/2” inlet diameter.
- Model LRS 6-1/2” rubber sink stopper.
- Model 980105 Mounting bracket for MRSS-LD.
- Model TD Drain flush/time delay for MRSS-LD.
- Model 288A Vacuum breaker, 1/2”.
Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

ITEM 725 – NUMBER NOT USED

ITEM 726 – STORAGE SHELF
Manufacturer/Model: Metro Metromax Q - Dry Storage Shelving.
Equipment:
- Shelf material/type: Metromax Q /Wire.
- Post material/size: Metromax Q /86”.
- MetroMax Q™ Shelf, open grid polymer with Microban® antimicrobial product protection, epoxy coat steel frame, (4) wedge connectors, NSF.
- Complete shelf assemblies indicated:
  Quantity Size Post
  One (1) 18” x 30” 4 per assembly
Configuration: 5 tiers; lower shelf adjusted to 8” aff, balance evenly spaced.
Special Instructions:
- Refer to Which Wich contact information at Part 2 – Article 2.29 for special procurement, if needed, for this item.

END OF SECTION 114000
SECTION 123662 – SOLID SURFACING MATERIAL

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. This Section includes solid surfacing for the following:
      1. Counter tops, shelving tops

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: Show thickness, finish, layout, and anchorage details. Indicate attachment methods, seams, joint treatments, and supports.
      1. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in countertops for architectural woodwork
      2. Show seam locations.
      3. Full-size details, edge details, attachments, etc
      4. Locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections
   C. Samples for Verification: For the following:
      1. Solid stone surfacing materials, 6 inches square.
      2. Cut sample and seam together for representation of seaming techniques.
      3. Indicate full range of color and pattern variation.

1.4 INFORMATIONAL SUBMITTALS
   A. Sustainable Documentation Submittals:
      1. Recycled Content:
         a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
         b. Include statement indicating costs for each product having recycled content.
      2. Location and distance from project of material manufacturer and point of extraction, harvest, or recover of raw materials for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      3. Include statement of material costs for each product screened through initiatives listed in 1.5.F.4.b in Section 018113.01 LEED DESIGN REQUIREMENTS.
      4. Low-Emitting Materials
         a. Product data indicating VOC content and completion of emissions testing and compliance per CDPH Standard Method v1.1-2010, using the applicable exposure scenario, for the following materials:
            1) Paints and coatings.
            2) Adhesives and sealants.
            3) Flooring.
            4) Products containing composite wood or agrifiber products or wood glues.
            5) Ceilings, walls, thermal, and acoustical insulation
         b. Product data for wet-applied products applied on site meeting the following requirements:
            1) Paints and coatings meeting acceptable VOC limits of the California Air Resources Board ( CARB) 2007, Suggested Control Measure (SCM) for architectural coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
            2) Adhesives and sealants meeting the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications.
      5. BPDO – Environmental Product Declarations
         a. Product-specific declarations of lifecycle impacts
         b. Industry-wide (generic) Type III EPD
         c. Product-specific Type III EPD.
      6. BPDO – Material Ingredients
a. Products with chemical inventory to at least 0.1% (1,000 ppm) through the following disclosure initiatives:
   1) Manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
   2) Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.
   3) Cradle to Cradle v2 Basic level or v3 Bronze level
   4) Declare product labels.

b. Products that have undergone chemical inventory and screening through the following initiatives:
   1) Greenscreen List Translator or full assessment of chemical ingredients to 100 ppm demonstrating no Benchmark 1 hazards.
   2) Cradle to Cradle v2 Gold, v2 Platinum, v3 Silver, v3 Gold, or v3 Platinum certification.
   3) REACH screening demonstrating no ingredients on the REACH Authorization or Candidate lists.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: Submit manufacturer’s recommended cleaning and maintenance procedures.

1.6 QUALITY ASSURANCE
   A. Fabricator Qualifications: Company specializing in fabricating engineered stone surfacing material with minimum 5 years experience.
   B. Fire-Test-Response Characteristics: Provide surfacing material with the following surface-burning characteristics (if required by code) as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
      1. Class I per ASTM E-84 including:
         a. Flame Spread: 25 or less.

1.7 PROJECT CONDITIONS
   A. Field Measurements: Where surfacing is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY
   A. Manufacturer’s 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Paints and Coatings
      1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDPH), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:
         a. 0.5mg/m³ or less,
         b. Between 0.5 and 5.0 mg/m³ or,
         c. 5.0 mg/m³ or more.
      2. All products must comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.
   B. Adhesives and Sealants
      1. Ninety percent, by volume, of products applied in the field inside the weatherproofing system must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure
scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:

a. 0.5mg/m3 or less,

b. Between 0.5 and 5.0 mg/m3 or,

c. 5.0 mg/m3 or more.

2. All products must comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005, as indicated in Section 018113.01 LEED DESIGN REQUIREMENTS.

C. Additional Low-Emitting Requirements

1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.

2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.

3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

D. BPDO – Environmental Product Declarations

1. Provide Environmental Product Declaration that meet one of the following disclosure criteria:
   a. Product-specific declaration of lifecycle impacts
   b. Industry-wide (generic) EPD
   c. Product-specific Type III EPD

E. BPDO – Material Ingredients:

1. Option 1: Provide permanently installed products that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
   a. Manufacturer inventory.
   b. Health Product Declarations (HPDs).
   c. Cradle to Cradle certifications.
   d. Declare product labels.

2. Option 2: Provide products that have undergone chemical inventory and screening through one of the following initiatives:
   a. Greenscreen.
   b. Cradle to Cradle.
   c. REACH.

2.2 QUARTZ SURFACING

A. Acceptable Manufacturer: Subject to compliance with requirements, provide one of the following products:

1. Ariaona Tile
2. Corian
3. Daltile
5. Silestone by Cosentino.
7. Cambria.

B. Basis of Design: Refer to Master Schedule.

2.3 MATERIALS

A. Solid Surfacing: Nonporous surfacing material composed of a unique blend of natural minerals and high-performance acrylic meeting the following criteria:

1. Wear and Cleanability: Passes per ASI Z124.3.

2. Abrasion Resistance: No loss of pattern per NEMA LD3-3.01 and ANSI Z 124.3; weight loss, 1,000 cycles, 0.2 gm; wear, 10,000 cycles, 0.008 inches.

3. Boiling Water Surface Resistance: No change per NEMA LD3-3.05.

4. High Temperature Resistance: No change per NEMA LD3-3.06.

5. Conductive Heat Resistance: No change per NEMA LD3-3.08.

6. Impact Resistance, Notched Izod: 0.28 ft-lbs/in of notch per ASTM D 256, Method A.

7. Impact Resistance, Ball Drop: 3/4 inch thick sheet, 36 inches with 1/2 pound ball, no failure per NEMA LD3-3.03.

8. Stain Resistance: Passes, Rating-41, modified with additional stains used, per ANSI Z124.3.

9. Weatherability: No change, 1000 hours, per ASTM D 1499.
10. Fungi and Bacteria: No attack per ASTM G 21, G 22.
11. Water Absorption: 3/4 inch sheet, 0.04 percent after 24 hours, 0.94 percent long term, per ASTM D 570.
12. Flammability: Solid colors per ASTM E 84.
   a. Flame Spread: Less than 5.
   b. Smoke Developed: Less than 15.
   c. Class Rating: 1.
13. Thickness: 1/2 inch (12 mm) unless noted or scheduled otherwise.
14. Colors and Sheen: Refer to Master Schedule.

B. Quartz Surfacing Material: Nonporous, sound, hard, durable, heat resistant engineered stone meeting the following criteria:
   2. Izod Impact Strength (ASTM D 256): Average 0.361 ft.lbs/inch of notch.
   3. Impact Strength (2 lb. Ball from 8’-0’): Passed.
   4. Liquid Absorption (ASTM C 97): 0.022 percent.
   5. Surface Burning Characteristics (ASTM E 84):
   7. Thickness: As scheduled.
   8. Appearance, Color, and Sheen: Refer to Master Schedule.

2.4 MISCELLANEOUS MATERIALS
A. Adhesives and Cements: Non-staining, type as recommended by engineered stone manufacturer.
   1. Waterproof, permanent material which will not induce mildew and fungus growth.
B. Joint Sealants: Two part color matched polyester knife grade adhesive.
C. Special Features: Provide edge treatments as detailed in Drawings.

2.5 FABRICATION
A. Assemble work at shop and deliver to job ready for installation. Manufacture in largest practical lengths with seams in least conspicuous locations.
B. Fabricate work square and to required lines.
C. Recess and conceal fasteners, connections, and reinforcing.
D. Design construction and installation details to allow for expansion and contraction of materials. Properly frame material with tight, hairline joints held rigidly in place.
E. Comply with adhesive manufacturer’s recommendations for adhesive shelf life, pot life, working life, mixing, spreading, assembly time, time under pressure and ambient temperatures.
F. Fabricate countertops with backsplash and side splashes to profiles indicated or detailed.
G. Fabricate items to profiles shown with connections and supports as detailed or as required for proper installation per manufacturer’s recommendations.
I. Do not exceed manufacturer’s recommended unsupported overhang distances.
J. Finish exposed surfaces smooth and polish to a sheen indicated.
K. Radius corners and edges.
L. Special Features: Provide [edge treatments,] [integral color feature strips,] [special inserts,] [and other detailed features].

PART 3 - EXECUTION
3.1 INSTALLATION
A. Install in accordance with manufacturer’s printed instructions and approved shop drawings. Provide templates and rough-in measurements.
B. Install surfacing true in line and plane, level, rigid and solidly adhered to substrate.
C. Pre-fit items: Adjust supports to make fit. Align joints over support framing.
   1. Provide intermediate supports to that material will not span more than 3 feet in any direction.
   2. Cantilevers shall not exceed 12 inches without supplementary support.
D. Apply dabs of mastic on supports; place items on supports and attach.
E. Install with minimum number of joints practical, using full-length pieces from maximum lengths available. Cope at returns and square at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Radius cutouts with minimum 3/8 inch corner radius.
F. Install splashes using adhesive. Apply adhesive to back surface only. Place thin bead of seam adhesive along edge where splashes seat.

3.2 TOLERANCES
A. Variation in Component Size: Plus or minus 1/8 inch over 10’-0” length.
B. Location of Openings: Plus or minus 1/8 inch from indicated location.
C. Install countertops level to within 1/8 inch in 10 feet.
D. Allow minimum 1/16 inch clearance between edges of countertops and adjacent walls.
E. Maximum Offset From True Position: 1/8 inch.

3.3 CLEANING
A. Clean work under provisions of Section 017700.
B. Clean and polish fabrications in accordance with manufacturer’s instructions.

END OF SECTION
UNIVERSITY OF NORTH TEXAS

SECTION 211100

FACILITY FIRE SUPPRESSION WATER-SERVICE PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and other Division 1 Specification Sections, apply to this Section

1.2 SUMMARY
   A. This section addresses underground fire-suppression water-service piping (fire mains) and its related components extending from the connection to the public water utility supply tap and extending into the building, as indicated on the approved design drawings.

1.3 SUBMITTALS
   A. Product Data: Manufacturer’s specifications for each type of product to be used on project.
   B. Shop Drawings and details indicating locations and depths of underground main and FDC piping; size of pipe, fittings and valves; type of pipe and fittings materials; size, type and location of pressure blocking; type of backfill material(s); type(s) of underground risers; location and type of vaults, backflow devices, flow meters, and yard valves.
   C. Copies of the contracting firm’s Texas Department of Insurance (TDI) Sprinkler Contractor Registration – General (SCR-G), Responsible Managing Employee - General (RME-G), Responsible Managing employee Underground (RME-U) and the required Texas Department of Insurance’s Liability Insurance Certificate, signed by a Texas Insurance Agent.

1.4 QUALITY ASSURANCE
   A. The contracting firm installing the underground fire main shall specialize in the design and installation of underground fire mains. The firm shall have a minimum of three years of verifiable design and installation experience in underground fire mains.
   B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
   C. The Contractor shall protect all piping materials from contamination during storage, handling and installation. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped or at the close of the day’s work.
   D. Regulatory requirements:
      1. Comply with all requirements of the public water purveyor’s, TCEQ and UNT’s requirements for connecting to the public utility water main.
      2. Comply with NFPA 24 and direction of UNT for materials, installation, tests, flushing, chlorination, valve and associated appurtenances for fire suppression water service piping.
   E. Minimum Required Inspections:
      1. Visual inspection of the installation shall be performed PRIOR TO covering any of the pipe, joints, fittings, valves, ductile iron, thrust blocks, restraints or other metal parts. Where any part is so covered prior to the visual inspection, the contractor will be required to uncover the part(s) for visual inspection at no cost to Owner.
      2. Pipe labeling must be turned upward and visible.
      3. Depth of bury of the pipe will be measured and verified.
      4. All angle fittings shall be pressure blocked with poured-in-place cement pressure blocks or anchored retaining straps. Pressure and gravity anchor blocks shall be appropriately sized per NFPA 24 or by a Texas Professional Engineer and bear onto undisturbed soil.
      5. All metal components being installed underground shall be externally coated for corrosion and poly-wrapped.
6. Hydrostatic Testing of the fire sprinkler underground main is required.
   a. All new fire service mains shall be tested hydrostatically at not less than 200 psi pressure for a
      minimum or two hours, or at 50 psi pressure in excess of the maximum static pressure when the
      maximum required static pressure exceeds 150 psi.
   b. A pressure loss of more than 5 psig, or leaks will result in a failed inspection.
   c. The Hydrostatic test shall be made by the installing contractor and witnessed by the Owner’s
      Representative.
7. Cleaning, disinfecting, flushing and biological testing:
   a. Underground fire mains being connected to any potable water utility line must be disinfected, flushed
      and pass bacteriological testing prior to being connected to any potable water utility line.
   b. Isolate fire main system from public water utility main with RPZ backflow prevention device.
   c. Clean new piping system and parts of existing system that have been altered, extended or repaired.
      i. Use flushing procedure described in NFPA 24 for flushing of pipe.
      ii. Use disinfecting procedure described in AWWA C651.
      iii. Once disinfecting test is complete and approved, re-flush the underground piping and perform
           bacteriological testing.
      iv. Samples for bacteriological analysis will only be collected from suitable sampling taps and
           collected in sterile bottles treated with sodium thiosulfate. Samples shall not be drawn from
           hoses, fire hydrants or unregulated sources.
8. Flushing, disinfecting, re-flushing and bacteriological sampling of lines shall be done by the installing
   contractor and witnessed by the Owner’s Representative.
9. Proper methods and equipment to perform the flush must be used. All piping used to flush must be
   properly secured or restrained. Owner’s Representative must approve of flushing method and equipment.

1.4 COORDINATION
   A. Coordinate location of underground fire main with fire sprinkler contractor, UNT Utilities Supervisor and public
      water purveyor’s requirements. Coordinate FDC location at the direction of the UNT System Fire Marshal.

PART 2 -- PRODUCTS

2.1 WATER PIPING MATERIALS
   A. Underground -- Polyvinyl Chloride (PVC) Pipe (NO EXCEPTION)
      1. American National Standard for PVC pipe 12 inches and under, AWWA Standard C900, Class 200
         (DR14).
      2. Pipe greater than 12 inches shall be AWWA Standard C905, Class 200 (DR14).
      3. Color: Blue
   B. Aboveground extension to backflow prevention device
      1. Where the underground fire service pipe emerges from below grade and does not immediately
         terminate with a control valve and backflow prevention device (double check valve assembly) in a
         readily accessible location, the above-ground extension of the fire service pipe shall be galvanized steel
         or stainless steel pipe run to the control valve and backflow prevention device located in a readily
         accessible location.
   C. Valves:
      1. Gate valves, 12" and under (resilient seated): AWWA C509 Standard
         a. General Description: Valves shall be full opening, iron body, non-rising stem, resilient seated wedge
            type so designed to have complete ZERO leakage with flow in either direction at pressures up to two
            hundred (200) psi. The valves shall be designed for throttling if required.
         b. Coating: Valves shall have all internal ferrous metal surfaces coated with an approved epoxy coating
            to provide a corrosion resistant barrier. The epoxy coating shall be holiday free with a minimum
            thickness of not less than four (4) mils. The coating shall be non-toxic after application and shall
            impart no taste to water.
         c. Operating stems: Valves shall have two (2) “O” ring stem seals. Valves shall have the thrust collar
            and bearing surfaces isolated from the waterway and be provided with continuous lubrication, or they
            shall be provided with non-corrosive thrust bearings above and below the thrust collar. Where the
operating nut exceeds forty eight (48) inches, in depth (below finish grade), a permanently attached extension shall be attached to the valve stem to bring it to the minimum depth of forty-eight (48) inches. All valves shall open by turning to the left and shall have a two-(2) inch operating nut or be hand-wheel operated as shown on the plans.

d. Approved Manufacturers:
   i. Mueller
   ii. Waterous
   iii. Kennedy
   iv. American-Darling
   v. Clow Corporation
   vi. J&S Valves

D. Fittings:
   1. Mechanical Joint: ANSI/AWWA-C110/A21.10 or ANSI/AWWAC153/A21.53 Standards
   5. Bends: ASTM D-3139. Megalug™ retaining glands or equal shall be used on all bends, tees and plugs
   6. Gaskets: ASTM F477 Standards

7. Bolts, Bolt-studs and “T” Head Bolts:
   a. Length: Shall be such that the ends project ¼ to ½ inch beyond surface of nuts.
   b. Ends: Chamfer or rounded.
   c. Threading: ANSI B1.1 coarse thread series, class 2A Fit. Bolt-studs may be threaded full length. Studs for tapped holes shall be threaded to match threading in holes.
   d. All bolts, bolt-studs and “T” head bolts (ANSI/AWWA C111/A21.11-80) shall be either:
      i. A242 high strength low alloy steel with enhanced atmospheric corrosion resistance (ASTM A325 Type III); or
      ii. Stainless Steel Grade 304 or 316 high strength bolts
   e. All nuts are to be A563 carbon alloy steel; Grade and finish to be C3.

Exception: All-thread rod to be used in thrust harness only, shall be high strength, corrosion-resistant alloy (ASTM A325 Type II) with hexagonal nuts. Where all-thread rods, nuts and washer are used, they are to be painted with “ROYSTON ROSKOTE MASTIC R28” Rubberized mastic as manufactured by ROYSTON LABORATORIES, INC. of Pittsburgh, Pennsylvania or equivalent.

PART 3 - REACTION RESTRAINTS AND THRUST-BLOCKING

3.1 Restraints and thrust blocking for all piping with mechanical coupling, push-on or mechanical joints, or similar joints subject to internal pressure shall be thrust-blocked or restrained per NFPA 13 for Underground Piping to prevent separation of the joints.

   1. Thrust-blocking shall be designed (placement, size, cement mix) by the RME or a Texas Registered Professional Engineer and shown on the installation plans.

PART 4 - EXCAVATION

4.1 Excavation: Excavation in general, shall be made in open cut from the surface of the ground and shall be no greater in width and depth than is necessary to permit the proper construction of the work.

A. Excavating and trenching shall be performed in accordance with State of Texas Law and OSHA requirements.

   1. Underground utilities in the area(s) being excavated shall be located, identified and marked by utility operator. Call TEXAS811 (dial 811), 48 hours in advance of the excavation and request line locates.

B. The amount of trench excavation to grade shall not exceed 100 (one hundred) feet from the end of the pipe laying operations and no excavation shall be 300 (three hundred) feet in advance of the completed pipe operations (includes backfilling). At the end of the workday, all trench excavation shall be backfilled or surrounded with substantial chain-link fencing at least 6 (six) feet in height, attached to steel poles that are firmly anchored into the ground. Any landscaping, irrigation system, paving or utility that is disturbed, removed,
or damaged during construction shall be replaced to original condition or better by the contractor.

C. Minimum bury depth: Minimum bury depth shall be forty-eight (48) inches from finished grade to the top of the pipe or as directed by the Owner.

D. Backfill Compaction:
1. Mechanical Method: Compaction and consolidation of the backfill materials shall be backfilled using the native material free of tree roots, large rocks and other deleterious materials, and compacted to 95 percent of maximum density as determined by ASTM D698 in six (6) inch lifts at optimum moisture content (to plus 4 percent above optimum moisture content) in areas subject to vehicular traffic, within 5 feet of and inside building footprints and other paved areas, and in ten (10) inch lifts in any other areas not specified. Where subject to vehicular traffic, within 5 feet of or inside the building footprint and other paved areas, density tests shall be performed at the rate of one test per 300 LF per one foot of trench depth.
2. Water Jetting Method: Water jetting is not allowed.

END OF SECTION
UNIVERSITY OF NORTH TEXAS
SECTION 211313
FIRE PROTECTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes labor and materials for the installation of a hydraulically calculated automatic, sprinkler system(s), complete in all respects and ready for operation.
   1. Work includes the design of a hydraulically calculated, wet-pipe, automatic sprinkler system, designed for 100% coverage of the building.
   2. In areas where ambient temperature cannot be maintained at 40°F or above, a dry pipe sprinkler system or a monitored heat tape system shall be provided.
   3. Design and installation of the sprinkler system shall be such that no parts interfere with general construction, doors, windows, heating, plumbing, air conditioning systems or electrical equipment.
B. System components for each zone shall include, but not be limited to:
   1. Zone control valve and test/drain assembly.
   2. Drain valve.
   3. Waterflow switches.
   4. Valve supervisory switches.
   5. Piping.

1.2 SYSTEM DESCRIPTION
A. The sprinkler system shall be an automatic fire sprinkler system supplied by a pressurized water supply (Municipal water main) to fusible sprinkler heads for the control of fire.
B. The sprinkler system shall be hydraulically designed to meet the more stringent of the requirements of the 2013 Edition of NFPA 13.
C. Work shall be installed in accordance with NFPA 13 and Owner’s direction. Devices and equipment shall be listed by Underwriters’ Laboratories, Inc. or Factory Mutual-approved, individually and as a system, as applicable.
D. Coordinate the location of sprinkler heads and piping such that it does not interfere with the installed ceiling configuration or other building construction and equipment.

1.3 HYDRAULIC CALCULATIONS
A. Prepare hydraulic calculations in accordance with NFPA 13 and with the following exceptions:
   1. Provide a minimum safety factor of 10 psi on all hydraulically calculated sprinkler systems.
B. Hydraulic calculations shall be performed by a State of Texas Licensed Responsible Managing Employee (RME) in the direct employ of the fire protection contractor, or by a Texas State Registered Professional Engineer (P.E.).
C. A recent fire flow test shall be the basis for the fire sprinkler design.

1.4 SUBMITTALS
A. Contractor’s Qualification Data: Copies of fire sprinkler firm’s TDI registration, RME License and Liability Insurance.
B. Product Data: For each type of product indicated.
C. Shop Drawings: Submit 3 (three) full-size sets of shop drawings for review. Plans must include the following:
   1. A “Wet” RME or Texas Professional Engineer’s signature and stamp, is required on all plan drawings and calculations.
   2. Plans shall be clear and legible and all sheets shall be in a common and appropriate scale;
   3. The following information shall be provided on the plans:
      a. Site plan showing location of the building, all fire hydrants, fire lanes, fire department connections and the fire service main location.
      b. Scale.
c. Floor plan.
d. Square footage.
e. Location of doors.
f. Intended use of each room is identified.
g. North arrow provided.
h. Location of the Fire Department Connection (FDC).
i. Occupancy classification.
j. Scope of Work.
k. Equipment List.
l. Hydraulic calculations for each design area.
m. A complete full-height cross section of the building.
n. Area of coverage of each sprinkler head.
o. Total area protected by each system.
p. Capacity of the dry system or antifreeze system.
q. Hydraulic node symbols and schedule.
r. Indicate all Riser Nipples (RN) or Drop Nipples (DN).
s. Elevations of sprinkler lines and node points.
t. Hanger details.
u. Hanger locations.
v. Sprinkler riser diagram.
w. Inspectors test connection detail.
x. Auxiliary drain details.
y. Size and location of standpipe hose stations, if applicable.
z. Description of the design area.
aa. Design density of each design area.
bb. Clearly indicate each remote area.
c. Provide graphic representation of the waterflow analysis.
dd. Provide the water supply test information.
ee. Provide notes to indicate the following;
ff. Design code.
gg. Responsible party with regards to freeze protection. If to be provided by others, indicate and provide drawings to indicate the heaters with your submittal.

4. The title block shall contain the following:
   a. Location of the installation.
b. Name and complete address of the business.
c. Name and complete address of the installing company.
d. Licensing information.
e. Date.
f. Drawn by.

5. A legend shall be provided to include:
   a. Symbol, sprinkler description, manufacturer, model number, and quantity for each device.
b. Pipe and fittings type.

D. Submit 3 (three) copies of equipment specification booklets containing all materials, equipment and products that are being provided for installation.
   1. Materials, equipment and products being used shall be identified in the specification booklets by an arrow or highlighter.

E. Field test reports and certifications for compliance with performance requirements shall be submitted to the owner. Include “Contractor’s Material and Test Certificate for Aboveground Piping”

F. All fire system submittals shall be provided to the UNT Fire Marshal for review and approval prior to any work.

G. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction including hydraulic calculations.

H. Welding certificates.

I. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13, Include “Contractor's Material and Test Certificate for
Aboveground Piping.

J. Field quality-control reports.
K. Operation and maintenance data.
L. Submit complete “As-Built” set of plans for each fire sprinkler and standpipe system.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Specialist Firm -- The installing contractor shall specialize in the design and installation of fire sprinkler systems and shall be registered as a fire sprinkler contractor by the Texas State Board of Insurance Underwriters (TDI) and shall have in its employ, a Responsible Managing Employee (RME), licensed by the Texas State Board of Insurance Underwriters (TDI). The contractor shall have a minimum of three years of verifiable installation experience with fire sprinkler systems.
   1. Installer’s responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services where needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test performed within past 90 days or less of design.
B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 PIPING AND FITTINGS

A. Piping and fittings:
   1. All exposed, aboveground piping shall be minimum schedule 40 steel pipe*, no exception, conforming to ASTM A53 or ASTM A795, Type E, Grade A. Comply with applicable governing regulations and industry standards.
   2. Piping and fittings for the fire main installed between the City’s water utility connection and the required backflow prevention device for the fire riser shall be ASTM approved materials for potable water systems.
   3. The piping system for a dry pipe system shall be schedule 40 galvanized steel.
B. *Pipe and fittings shall be domestically manufactured by one of the manufacturers listed in the latest edition of the American Petroleum Institute (API) approved manufacturers listing.
C. Threaded Fittings: Class 150 malleable iron, ANSI B16.3, for pipe sizes 2-inch and less.
D. Malleable Iron Threaded Unions: ANSI B16.3, select for proper piping fabrication and service requirements including style, end connections, and metal-to-metal seats (iron, bronze, or brass), plain or galvanized as specified.
F. Steel Flanges/Fittings: ANSI B16.5, including bolting, gasketing, and butt weld end connections. Fittings same thickness as pipe.
G. Forged Steel Socket-welding and Threaded Fittings: ANSI B16.11, rated to match schedule of connected pipe.
H. Wrought Steel Butt-welding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns; rated to match connected pipe.
I. Flanged Fittings: Comply with ANSI B16.5 for bolt-hole dimensioning, materials, and flange thickness.
J. Flange Bolts: Bolts shall be carbon steel ASTM A307 Grade A hexagon head bolts and hexagonal nuts. Where one or both flanges are cast iron, furnish Grade B bolts. Cap screws utilized with flanged butterfly valves shall be ASTM A307 Grade B with hexagon heads.
K. Flange Bolt Thread Lubricant: Lubricant shall be an anti-seize compound designed for temperatures up to 1000°F and shall be Crane Anti-Seize Thread Compound or approved equal.
L. Saddle tap fitting are not allowed.

1.7 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Welding Materials: Comply with ASME Boiler and Pressure Vessels Code, Section 11, Part C, for welding materials.
B. Gaskets for Flanged Joints: 1/16 inch thick for pipe size 10 inches and smaller and 1/8 inch thick for all pipe size 12 inches and larger. Pingtype shall be used between raised face flanges and full face-type between flat face flanges with punched bolt holes and pipe opening. Gaskets shall be Garlock Style 3400 compressed non-asbestos or equal.

C. Dielectric Unions: Provide dielectric unions at all pipe connections between ferrous and nonferrous piping. Unions shall be “Delvin” as made by Pipeline Seal and Insulator Company or “EPCO” as made by Epco Sales, Inc. and shall have nylon insulation.

D. Mechanical couplings may only be used for pipe sizes over 2-inch, to engage and lock grooved or pipe ends and to allow for some angular deflection, contraction and expansion.
1. Couplings shall be positive lock type and shall consist of ASTM A536 ductile iron housing, c-shaped composition sealing gasket and carbon steel bolts conforming to ASTM A183.
2. Gasket Material for wet systems shall be EPDM.
3. Gasket material for dry pipe systems shall be silicone.
4. All couplings shall be UL listed and approved.
5. Provide only full flow (no-fabricated) fittings. Snap joint couplings, outlet couplings, cut-in style couplings, reducing couplings, mechanical-T style couplings, pressfit couplings, and plain end type couplings are not allowed.
6. When mechanical couplings are used, ONLY grooved type fittings and pipe shall be used, no plain end fittings or pipe. Grooved couplings and fittings shall be manufactured by Victaulic, “Firelock” or approved equivalent.

E. Water Flow Switches: Viking or approved equal water flow switch with adjustable retard feature. Switch shall be double-pole double-throw type and shall be rated at least 7 amperes at 125/250 volts.

F. Valve Supervisory Switches:
1. Provide on each valve, controlling or shutting-off sprinkler system where shown on drawings or/and on all valves required by NFPA 13, or any portion thereof.
2. Provide UL listed unit, with either one single pole double throw switch or two single pole double throw switches as required. Switch shall be compatible with installed valve for standard mounting. Manufactured by Potter Roemer No. 6220, or approved equal.

G. Sight Flow Connection: Provide acrylic sight flow connection in all test lines, conforming to NFPA 13.

H. Pressure Gauges: Potter-Roemer Fig. No. 6240 or approved equal 3-1/2 inch diameter polished brass case, 1/4 inch NPT male connection, glass enclosed, 0-300 psi dial pressure gauges with isolation valves.

I. All hangers and supports shall comply with NFPA 13.

J. Fire Valve Cabinet (FVC): Where required, Potter-Roemer Fig. No. 18210, recessed fire valve cabinet consisting of 20 gauge steel cabinet with continuous hinge, re-coatable white polyester finish.

K. Fire Department Valve (FDV): Where required, provide Potter Roemer No. 4060-D, UL Listed and FM approved 2-1/2” cast-brass angle valve with iron hand-wheel, female inlet by 2-1/2” male NST hose thread outlet, 300 pound rating, with female NST hose thread cap with pin lugs and chain.

L. Wall Mounted Fire Department Siamese Connection: Potter Roemer Fig. No. 5785-C or approved equal, free standing, cast bronze body, with 2-1/2”, UL listed, rough chrome plated body with polished chrome plated trim, caps and chains with NST hose threads.

M. Remote Located Fire Department Connection: Where required by Owner, install free standing Potter Roemer No. 5761-5764 Body, cast bronze body with Siamese NST 2-1/2” outlets with polished chrome plated finish, with caps and chains, with NST threads.

N. Roof Manifold: Where required, provide free standing Potter Roemer No. 5882 Body with 4065 Valves or approved equal, cast bronze body with 2-1/2” outlets with cast brass angle hose valves rated for 300 psi with polished chrome plated finish, with caps and chains, with NST threads.

O. Post Indicator Valve: Where required, provide adjustable, free standing indicating post and valve, consisting of UL/ FM approved non-rising stem gate valve and indicating post. Gate valve shall have iron body with non-rising stem, bronze mounted, indicator post flange, 175 psi non-shock rating, flanged ends. Indicator post shall be free standing and shall have a cast iron body, plexiglass window and an 18 inch adjustment span with handle and locked and chained in open position. Manufactured by Mueller Valve No. A-2052 and Indicating Post No. A-20801, or approved equal.
PART 2 - PRODUCTS

2.1 SPRINKLERS
   A. Unless otherwise specified, sprinkler heads shall be a quick response type with standard (155°F) temperature rated fusible link, 1/2 inch orifice and a 5.6 K factor.
      1. Heads located within the air streams of heat emitting equipment and serving Elevator Machine Rooms, Elevator Shafts and Boiler Rooms shall have an intermediate (200°F) temperature rated fusible link.
      2. Install corrosion-resistant sprinkler heads where they are exposed to weather, moisture, or corrosive vapors.
      3. Heads installed where they might receive mechanical injury or are less than 7 feet above the floor level shall be protected with approved guards in accordance with NFPA 13.
      4. Sprinklers in areas with suspended ceilings shall have pipe and fittings located above the suspended ceiling.
   C. Sprinkler heads shall be UL Listed and approved.
   D. Provide metal cabinet containing a stock of spare sprinkler heads of all types and ratings installed per NFPA 13.
      1. Locate cabinet where temperature will not exceed 100°F.
      2. Location shall be approved by the Owner.
      3. Number of spare sprinklers shall conform to NFPA 13.
      4. Provide a sprinkler wrench in the cabinet, for each different type sprinkler head.
   E. Sprinklers shall be provided in electrical rooms unless otherwise noted on the drawings.
   F. The use of extended coverage type heads must have prior approval.
   G. The use of UL listed flexible type head assemblies are permitted.

2.2 VALVE SUPERVISORY SWITCHES
   A. Contractor shall furnish and install supervisory switches. Coordinate wiring of switches with Electrical Contractor.

2.3 WATERFLOW SWITCNESS
   A. Provide Viking VSR-F or equivalent waterflow switches, with adjustable retard feature in the supply pipe to each zone for remote alarm. Switch shall be double-pole single-throw type and shall be rated at least 7 amperes at 125/250 volts.
   B. Waterflow switches shall be furnished and installed by this Contractor and wired by Fire Alarm or Electrical Contractor. Coordinate wiring of flow switches with appropriate contractor.

2.4 BUILDING FIRE ALARM SYSTEM INTERFACE
   A. Each zone control assembly shall provide an alarm signal output to the Building Fire Alarm System whenever there is waterflow in the zone. Coordinate with Fire Alarm Contractor.
   B. Each valve which controls the flow of sprinkler system water shall be monitored by the Building Fire Alarm System. Coordinate with Fire Alarm Contractor.

2.5 SPRINKLER ALARM CHECK VALVE ASSEMBLY
   A. Provide 175 psi rated automatic sprinkler valve with one or two pole (as required) flow detectors, pressure switch and associated trim for a complete working system.
   B. Provide products manufactured by Reliable, Viking or approved equivalent.

2.6 SPRINKLER INSPECTOR’S TEST ASSEMBLY
   A. Provide NFPA 13 compliant UL Listed and approved sprinkler system inspector’s test assembly, consisting of sight glass, tamper resistant test orifice, test and drain ball valve, rated for 300 psi, manufactured by AGF Model 1000, or approved equal.

2.7 FREEZE PROTECTION FOR SPRINKLER PIPE SYSTEM
   A. Fire protection piping within unheated crawl spaces and attics shall be protected from freezing by one of the following methods:
1. Raychem XL-Trace®, or equivalent, listed and supervised thermostatically controlled heat-trace tape, capable of maintaining pipe temperature above 40° F., shall be installed along the pipe system and sprinkler heads per manufacturer’s installation instructions; pipe shall also be insulated with minimum 1 inch thick Pittsburg Corning Foamglas®, John Manville Mico-Lok® Fiber Glass Pipe Insulation, or approved equivalent, type insulation. Where insulation is subject to damage, a metal outer jacket shall be installed over the insulation.

2. Provide a dry pipe sprinkler system with all necessary components to protect the sprinkler system pipe and heads located in the unheated space.
   a. Dry sprinkler pipe to be schedule 40 galvanized steel pipe conforming to ASTM A53 or ASTM A795, Type E, Grade A.
   b. Components shall be rated for a minimum 175 psi working pressure.
   c. Dry Pipe Valve. Provide UL listed and FM approved externally resettable dry pipe valve (Viking, or approved equal) and appurtenances. Equip and connect as required by NFPA 13.
   d. Provide water and air pressure gauges, priming water level indicator, alarm test bypass and accelerator. Include all necessary pipe fittings and accessories to provide a complete dry pipe Sprinkler System.
   e. Provide air maintenance devices consisting of air relief valve, bypass valve, shut-off valves; low and high air pressure supervisory switches and water flow supervisory switch with 120 volt single phase power requirement and adjustable pressure rating of 14 to 60 psi, manufactured by Reliable or approved equal.
   f. Provide a quick opening device equipped with an anti-flooding device (Viking or approved equal) for each system riser.
   g. Provide an oil-free air compressor for dry pipe sprinkler system applications, permanently lubricated, direct drive, air filter, safety relief valve set at 50 psi, UL listed, sized to fill dry system within 30 seconds. Air compressor shall be either pipe mounted or floor mounted. Manufactured by Reliable or approved equal.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Piping and joints shall be full bore reamed, for all joint types.

D. Slag shall be removed and cleaned at all welded joints.

E. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

F. Install unions adjacent to each valve in pipes NPS 2” and smaller.

G. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

H. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

I. Install sprinkler piping with drains for complete system drainage.

J. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

K. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

L. Install hangers and supports for sprinkler system piping according to NFPA13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged
for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. Fill sprinkler system piping completely with water.

3.2 PIPING INSTALLATION
A. Piping shall be concealed, except by prior approval of Owner. Install all piping parallel to or at right angles to the column lines of the building wherever possible.
B. Sprinklers in suspended ceilings shall be provided with arm over supply line.
C. Individual sprinkler head piping shall not connect to cross-main from the bottom or side of cross-main.
D. In electrical rooms, only sprinkler piping which serves the sprinkler heads in that room are allowed.
E. Wet sprinklers shall not be located in IT closets or rooms without prior approval of Owner. Wet sprinkler piping shall not be located in IT closets or rooms. Provide a plugged, 1 inch “T” fitting outside of and in close proximity to each IT closet location for future branch line installation.
F. Grade piping to eliminate traps and pockets and for drainage per NFPA 13. Where air pockets or water traps cannot be avoided, provide gate valves with hose connections for drainage.
G. It shall be the responsibility of the Fire Protection Contractor to coordinate electrical equipment locations with the Electrical Contractor and design the fire protection piping system such that no piping is routed over electrical equipment, unless it serves that room.
H. Changes in direction, branches, offsets etc., shall be made with standard pipe fittings. Holes in the main for branches shall be made with a hole-cutting machine and a standard "Weld-O-Let" or 'Thread-O-Let' fitting used. Burning holes in the fire protection System Piping will cause that section of the piping to be cut out and replaced at the Contractor's expense.
I. Pipe shall be reamed to full pipe diameter before joining:
   1. Screwed joints shall be made with standard pipe thread and an approved compound applied to the male thread only.
   2. Welded joints shall be made in accordance with the procedure outlined in the ANSI piping code.
   3. Valves and specialties shall be screwed or flanged joints.
   4. Grooved joints shall be made in accordance with manufacturers recommendations with UL listed and approved couplings or weld-o-let connections to pipe mains shall be full bore.
   5. Slag, etc. shall be removed.
J. Install unions or flanges at equipment connections and as indicated on the Drawings.
K. Cold-springing piping will not be permitted. Install piping with adequate support to prevent strain on the equipment and to allow for piping system expansion and contraction.
L. Welded joints on pipe runs shall be made with continuous welds and with pipe ends beveled before fabrication. Piping shall be carefully aligned prior to welding and no metal shall project within the pipe.
M. Piping shall be sized as required by applicable codes and as indicated on the Drawings.
N. Provide all test and drain lines as required by Section 8.17.4.1, of NFPA 13:
   1. Pressure gauges, signs, and other such standard appurtenances shall be furnished as required for a complete installation in accordance with NFPA 13.
   2. Provide nameplate data sign at the zone controlling valve to identify the system as a hydraulically designed system indicating the location and basis for design in accordance with NFPA 13.
   3. Install sprinkler piping so that it can be thoroughly drained, and where practicable shall be arranged to drain at the zone drain valve. The zone drain valve shall be capable of a full discharge test without allowing water to flow onto the floor. All drips and drains shall conform to NFPA 13.
   4. Field changes in the piping layout or pipe sizes shall not be made without the prior approval of the Owner.

3.2 CUTTING AND PATCHING
A. General: Cut and patch walls, floors, etc., resulting from work or by failure to provide proper openings or recesses in new construction.
B. Methods of Cutting:
   1. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Owner.
   2. Impact-type equipment shall not be used except where specifically acceptable to the Owner.
3. Openings in precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled to exact size.

C. Restoration:
1. All openings shall be restored to “as-new” condition for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Masonry:
1. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry.
2. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation.
3. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Owner.
4. Special Note: No cutting, boring, or excavating which will weaken the structure shall be undertaken. A Texas Registered Professional Engineer shall be consulted in these cases. Necessary structural repairs shall be designed by a Texas Registered Professional Engineer.

3.3 TESTS AND INSPECTIONS
A. Inspections, examinations and tests required by the authorities or agencies specified shall be arranged and paid for by the Fire Protection Subcontractor, as necessary, to obtain complete and final acceptance of the system as installed. The certificates of inspection shall be in quadruplicate, and shall be delivered to the Owner.

B. Fire protection piping systems shall be hydrostatically tested by the Contractor upon completion of the installation as required by NFPA 13 in the presence of the Owners Representative.
   1. The fire protection piping systems shall be hydrostatically tested per the requirements listed in NFPA 13.
   2. When hydrostatic and alarm tests have been completed and all necessary corrections made, a material and test certification shall be provided in accordance with NFPA 13.
   3. Final inspection shall include full flow testing through the inspectors test connection.
   4. Actuation of the flow switch shall occur within one minute of opening of the inspector’s test valve.
   5. Final tests shall be witnessed by the Owner’s Representative.

C. Sprinkler system zone control assemblies shall be tested to demonstrate proper operation of the flow switch and valve supervisory switch.

D. Arrange and pay for all tests and inspections required by authorities having jurisdiction.

E. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.3 JOINT CONSTRUCTION
A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system’s pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2” and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2” and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 PERIODIC INSPECTION SERVICE
A. After completion of the fire protection system installation and at the beginning of the guarantee period, the Automatic Sprinkler Subcontractor shall execute the National Automatic Sprinkler and Fire Control Association, Inc., Standard Form of "Inspection Agreement", without change in the Contract amount, calling for four inspections of the fire protection system during the warranty period.
B. During the warranty period, inspections shall be in accordance with the Inspection Agreement, plus the following maintenance to be performed during the course of the fourth inspection:
   1. Operation of all control valves.
   2. Lubrication of operating stems of all interior valves.
   3. Operation of all alarms, supervisory switches, air compressors, alarm trip switches, flow switches, and similar items.
   5. Lubrication of Fire Department valve hose connections.
   6. The standard form of the National Automatic Sprinkler and Fire Control Association, Inc., "Report of Inspection", shall be filled out in triplicate after each inspection and the copies sent to the Owner.

3.4 VALVE AND SPECIALTIES INSTALLATION
A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
C. Install check valve in each water-supply connection. Install double check, fire service rated backflow preventer in connection to potable-water-supply sources.
D. Specialty Valves:
   1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.5 IDENTIFICATION
A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.5 SPRINKLER AND COVER PLATE (RECESSED SPRINKLER HEADS) INSTALLATION
A. Sprinkler heads and recessed sprinkler cover plates shall be protected from damage, dirt and other deleterious materials during construction. Remove and replace any damaged sprinkler or sprinkler cover plate, or sprinklers or cover plates having any foreign material other than factory finish. Sprinkler heads and cover plates shall not be cleaned unless by a method approved by the manufacturer AND accepted by the Owner.

3.6 ESCUTCHEON INSTALLATION
A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.7 SLEEVE INSTALLATION
A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
B. Sleeves are not required for core-drilled holes.
C. Permanent sleeves are not required for holes formed by removable PE sleeves.
D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
E. Install sleeves in new partitions, slabs, and walls as they are built.
F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint.
G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint.
H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
I. Seal space outside of sleeves in concrete slabs and walls with grout.
J. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.8 SLEEVE SEAL INSTALLATION
A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.9 IDENTIFICATION
A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.10 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Tests and Inspections:
   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   4. Energize circuits to electrical equipment and devices.
   5. Start and run excess-pressure pumps.
   6. Coordinate with fire-alarm tests. Operate as required.
   7. Verify that equipment hose threads are NST.
   8. Sprinkler system zone control assemblies shall be tested to demonstrate proper operation of the flow switch and valve supervisory switch.
   9. Arrange & pay for all tests and inspections required by authorities having jurisdiction.
C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.11 PERIODIC INSPECTION SERVICE
A. Provide periodic inspections service after completion and Owner acceptance.
B. This agreement shall be executed at no cost to the Owner and shall include four inspections of the entire sprinkler system during the warranty period, each with a NASFCA “Report of Inspection to the Owner”. The final inspection shall include operation and lubrication of all valves, cleaning of all alarm valves and operational testing of all system Electrical and alarm components.

3.12 TRAINING
A. The installation contractor shall provide a minimum of 4 hours of training for the Owner in operation and maintenance of the wet-pipe and/or dry pipe sprinkler system.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This section addresses electric fire pump motors, fire and jockey pumps, respective related controllers and specialty accessories incorporated into a building fire sprinkler system.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
1. Fire and jockey pump cut sheets with all pump capacities, UL/FM approval, pump characteristics, features and accessories clearly indicated. Include pump motor brand name and performance data.
2. Pump curves with selection point clearly indicated.
3. Fire and jockey pump motors must be listed for fire pump use and meet NFPA 20 standards. Provide Totally Enclosed, Fan Cooled (TEFC) fire pump motors. Provide complete motor specifications and data.
   a. U.S. Motor is not an acceptable motor manufacturer for fire pump motors.
4. Fire Pump Controller Automatic Transfer Switch and cut sheets with features and options clearly indicated, wiring diagrams, nameplate text and a written system operational sequence.
5. Jockey pump controller wiring diagram.
C. Product Certificates: For each fire pump, from manufacturer.
D. Source quality-control reports.
E. Field quality-control reports.
F. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pumps, controllers, automatic transfer switch, and accessories in factory-fabricate water resistant wrapping.
B. Handle pumps, controllers, automatic transfer switch, and accessories carefully to avoid damage to material components, enclosure, and finish.
C. Store pumps, controllers, automatic transfer switch, and accessories in a clean, dry space and protect from the weather.
1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Fire Pump:
      a. S.A. Armstrong Limited.
      c. Aurora.
      d. Peerless Pump, Inc.
      e. Patterson Pump Company; a subsidiary of the Gorman-Rupp Company.
   2. Electric Fire Pump Motor:
      a. Lincoln
      b. WEG
      c. Marathon
   3. Jockey Pump:
      a. Grundfos.
      b. Goulds.
      c. S.A. Armstrong Limited.
   4. Fire Pump Controller:
      a. Master.
      b. Firetrol, Inc.
      c. Metron.
      d. Torna Tech

2.2 ELECTRIC FIRE PUMP SYSTEM

A. General:
   1. Provide a complete and operational fire pumping system consisting of horizontal split case electric fire pump, jockey pump, combination fire pump controller/automatic transfer switch, jockey pump controller, flow testing equipment and associated components as specified and as scheduled and shown on Drawings.
   2. Equipment furnished and the complete installation shall be in accordance with NFPA 20. Pump and controller/automatic transfer switch shall bear the UL label.
   3. Refer to schedule on Drawings for pump size and design characteristics. Size of the fire pump is to be based on flow test information.

B. Fire Pump:
   1. Electric driven fire pump shall be a horizontal split case centrifugal type, UL Listed, FM-approved and in compliance with all requirements of NFPA 20.
2. Pump shall be of bronze-fitted construction with Class 30 cast iron casing, bronze impeller, renewable bronze sleeves and bronze wear rings, packed stuffing boxes and grease lubricated ball bearings in motor.
3. Pump shaft shall be high strength steel.
4. Pump shaft deflection shall not exceed 0.002 inch at the stuffing boxes when operating at ±25 percent of the best operating point.

C. Pump suction flange shall be rated for 125 psi working pressure on inlet side and the discharge flange shall be rated for 250 psi working pressure.

1. Fire pump shall be factory mounted on a pedestal and connected through a rigid split coupling. Motor shall have a 1.15 service factor shall be sized so as to not exceed the permissible loading limits of NFPA 20 at any point on the pump performance curve.
2. Locked rotor current shall not exceed the values specified in NFPA 20.
3. Each motor shall be of such capacity that at rated voltage under any pump operating condition, the full load ampere rating shall not be exceeded except as permitted by the service factor stamped on the motor nameplate.
4. Motors shall be compatible with the specified motor controller.
5. Motor electrical characteristics and capacity shall be as scheduled and shown on the Drawings.

D. Fire pump capacity shall be as scheduled on Drawings.

E. Pump shall be hydrostatically tested at 1.5 times the maximum working pressure but in no case less than 250 psig.

F. Shutoff head of fire pump must exceed dead head of fire pump by 10 psi.

G. Accessories:
   1. Provide pump accessories per NFPA 20, including, but not limited to:
      a. 3/4" minimum casing overheat relief.
      b. 3-1/2" dial liquid filled compound suction pressure gauge.
      c. 3-1/2" dial liquid filled discharge pressure gauge.
      d. Eccentric tapered suction reducer.
      e. Concentric tapered discharge increaser.
      f. Base-mounted coupling guard.
      g. Fire pump accessories shall be approved for domestic water use.
      h. All relief drains to floor drains.

H. Factory Testing: Fire pump shall be factory tested and certified in accordance with NFPA 20. Certified performance test results and curves shall be delivered to the Owner for review prior to final fire pump acceptance.

I. Field Service: Pump supplier shall provide pump checkout, start-up, testing and adjusting of system components and shall perform field certification testing on the installed fire pump. The pump supplier shall also train the Owners Engineer in the proper operation and maintenance of the fire pump system.

2.3 FIRE PUMP CONTROLLER/AUTOMATIC TRANSFER SWITCH

A. The fire pump controller/automatic transfer switch shall be of the combined manual and automatic type, solid state reduced voltage, minimum, 100,000 amp withstand rated, full service, and UL listed and FM approved per NFPA 20 currently enforced. The fire pump controller/automatic transfer switch shall be housed in a NEMA 2 floor-mounted, non-vented enclosure, mounted on a 4" thick concrete pad, and include the following:
1. Isolation switch with a separate NEMA operating handle interlocked with circuit breaker.
2. Time delay circuit breaker set at 300 percent motor full load current with external LED supervised locked rotor protector, instant and time delay trip test switch, and external NEMA operator handle.
3. Differential adjustable pressure switch with energize to start relay.
4. Minimum run timer, 10 minutes non-adjustable, with timed out LED indicator.
5. POWER AVAILABLE and PHASE REVERSAL pilot lights wired to the line side of the motor starter. Indicating lights shall be long life LEDs.
6. Digital ammeter and voltmeter with three phase selector switch, calibrated traceable to NBS standards.
7. Built in alarm panel and supervisory power pilot light powered from separate reliable 120 VAC power source with lights, bell, silence button, and lamp test switch for indication of PUMP RUNNING, POWER FAILURE, PHASE REVERSAL, TRANSFER SWITCH IN EMERGENCY, ISOLATION SWITCH OPEN. A status panel for start and run demands shall also be included. All indicating lights shall be long life LEDs with lamp test feature.
8. START and STOP pushbuttons for manual control.
9. Two sets each of dry form “C” contacts for remote indication at main fire alarm panel for PUMP RUNNING, POWER FAILURE, PHASE REVERSAL, TRANSFER SWITCH IN EMERGENCY, ISOLATION SWITCH OPEN, and SUPERVISORY POWER FAILURE.
10. Digital paperless alarm recorder.
11. Three non-fused control power transformers, surge protector wired to the load side of the isolation switch with short circuit protection, magnetic contactors with externally operable mechanical start mechanism, and restart delay timer.
12. Automatic transfer switch housed in a separate compartment of the fire pump controller. The transfer switch shall have normal power light and monitors, emergency power light and monitor, test switch, and time delays for generator start, transfer to emergency, and retransfer to normal. All control and monitor components shall be individually serviceable. Unit shall have, as a minimum, a 5 year warranty on parts and a 2 year warranty on labor.
13. The fire pump controller and transfer switch shall be for fire pump scheduled horsepower, UL 1008 listed, 3 phase motor, rating for highest low voltage (i.e. 208, 240, 460) available at site. Manufactured by Firetrol No. FTA1900, or approved equal by Master or Metron.

B. The fire pump controller/ATS shall also have the following control functions:
1. Provide an interlock between the fire pump controller and ATS that will, when the fire pump is running, inhibit the automatic transfer switch from "TRANSFERRING-TO-NORMAL" power source as long as the fire pump is operating on the “EMERGENCY” source.
2. Interlock control wiring from the Fire Pump Controller to the Fire Pump Automatic Transfer Switch shall be factory-installed.

2.4 FIRE PUMP WIRE

A. Electrical wiring for fire pump, jockey pump and associated controllers shall be installed by a Texas Department of Licensing and Regulations (TDLR) registered and licensed Electrical Contractor.
B. Electrical supply conductors for the fire pump motor shall be sized according to NFPA 70 for Fire Pumps.
C. Electrical supply conductors for the fire pump motor shall be capable of maintaining integrity and operation for a minimum of two hours under fire exposure condition. Acceptable wire is as follows:
1. Lifeline® Power Cable RHW-2 Two-Hour Fire Resistive Cable;
2. VitaLink® MC Two Hour Fire Rated Power Cable.

2.5 FLOW TESTING EQUIPMENT

A. The fire pump supplier shall furnish a FM approved flow meter for testing the fire pump.
B. The flow meter shall be flanged venturi type BV as manufactured by Aeroquip, or approved equal.
C. The installing contractor shall submit approval drawings of the proposed piping layout, which shall conform to the requirements prescribed by the flow meter manufacturer.

2.6 FIRE PUMP TEST HEADER

A. Provide wall mounted ductile iron body outlet fire pump test connection, complete with polished chrome plated exposed surfaces, with plate lettered “Pump Test Connection”.
B. Chrome plated brass NRS hose gate valves, with loose bonnet caps and chains, 2-1/2 inch gate valves with local fire department threads, back outlet, manufactured by Potter Roemer No. 5864-D-2, or approved equal.

2.7 JOCKEY PUMP

A. General: Provide a complete and operational electric driven fire jockey pump and jockey pump controller as specified herein and as scheduled and as shown on the Drawings.
B. Pump:
   1. The jockey pump shall be a centrifugal multi-stage pump with stainless steel impeller and shaft, and cast iron base, and EPDM O-rings.
   2. Jockey pump capacities shall be as scheduled on the Drawings.
   3. Pumps, casings, flanges, and mechanical seals shall be rated for operation with the working pressures scheduled.
C. The jockey pump shall be mounted on a fabricated cast iron drip lip base and shall be close-coupled or flexible coupled to an energy efficient, high efficiency open drip-proof motor. Motor electrical characteristics and capacity shall be as scheduled or listed on the drawings.
D. Relief Valve: Provide the fire jockey pump with a factory-mounted bypass relief valve complete with piping. Set relief valve to relieve at a pressure of 25 psig above design total dynamic head to prevent motor overload and system damage.
E. Jockey Pump Controller: The electric jockey pump controller shall be UL listed and NFPA 70 compliant. Unit shall include a circuit breaker, magnetic starter with overloads, 0-300 psig pressure switch, H-O-A selector switch, minimum run timer, dual fused control transformer, two sets of remote form “C” contacts for pump running, and a NEMA 2 enclosure, Master control Model PMC series, or Firetrol Model FTA500, or Metron.
F. Field Service: The pump supplier shall provide pump checkout, start-up, testing and adjusting of system components and shall perform field certification testing on the installed jockey pump. The pump supplier shall also train the Owners Representatives in the proper operation and maintenance of the jockey pump system.

2.8 GROUT

B. Characteristics: Nonshrink and recommended for interior and exterior applications.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.9 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
   1. Verification of Performance: Rate fire pumps according to UL 448.
   B. Fire pumps will be considered defective if they do not pass tests and inspections.
   C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of fire pumps.
B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
B. Equipment Mounting: Install fire pumps and jockey pumps on concrete bases.
   1. Where not otherwise indicated, install 4 inch thick concrete foundation pads for indoor floor-mounted equipment, except where direct floor mounting is allowed by prior approval.
   2. For equipment mounted outdoors, provide concrete foundations a minimum of 6 inches above grade.
   3. Provide reinforcing steel as recommended by the structural engineer and as detailed on the Drawings.
   4. Pour pads on roughened floor slabs, sized so that outer edges extend a minimum of 3 inches beyond equipment. Trowel pads smooth and chamfer edges to a 1-inch bevel. Secure equipment to pads as recommended by the manufacturer.
   5. Anchor Bolts. Furnish and install galvanized anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the manufacturer of the equipment and shall be located by means of suitable templates. When equipment is placed on vibration isolators, the equipment shall be secured to the isolator and the isolator secured to the floor, pad, or support as recommended by the vibration isolation manufacturer.
      a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18" centers around the full perimeter of concrete base.
      b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

d. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Setting of Equipment. Provide permanent and temporary shoring, anchoring, and bracing required to make parts stable and rigid; even when such shoring, anchoring, and bracing are not explicitly called for.

a. Equipment must be leveled and set plumb.

C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

D. Support piping and pumps separately so weight of piping does not rest on pumps.

E. Install valves that are same size as connecting piping.

F. Install pressure gauges on fire-pump suction and discharge flange pressure-gauge tappings.

G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers’ wiring diagram submittals to Electrical Contractor.

I. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

J. Engage a factory-authorized service representative to perform startup service.

K. Complete installation and startup checks according to manufacturer's written instructions.

3.3 ALIGNMENT

A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 211313, Wet-Pipe Sprinkler Systems. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
   1. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
   2. Test according to NFPA 20 for acceptance and performance testing.
   3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   6. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
   7. Prepare test and inspection reports.

E. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps. Coordinate training with Owner.

B. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans.

END OF SECTION
SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

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. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Mechanical sleeve seals.
   5. Sleeves.
   7. Grout.
   8. Plumbing demolition.
   9. Equipment installation requirements common to equipment sections.
   10. Painting and finishing.
   11. Concrete bases.
   12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. PE: Polyethylene plastic.
   4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. In order to make the submittal review process more efficient for all parties, all MEP submittal data and shop drawings shall be reviewed on a designated “Submittal Review Day”. The “Submittal Review Day” will consist of having the Engineer, General Contractor, Electrical Contractor and Mechanical HVAC Contractor review the submittals together, in the same room. The Architect and Owner’s representative(s) will be invited to attend the “Submittal Review Day”. Key Manufacturer’s Representatives shall attend the review or be available by phone for immediate response to questions and/or comments. All submittals will be reviewed and stamped by the Engineer the same day. The Contractor is responsible for setting time and place for this review and inviting all required parties. All parties shall be given a minimum of 7 days notice prior to submittal review day.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, “Structural Welding Code--Steel.”

B. Steel Pipe Welding: Quality processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications.”
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.8 GENERAL

A. For Products specified by reference to an association or trade standard, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

B. The date of the standard is that in effect on the date of issue of Contract Documents, except when a specific publication date is specified. Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.
1.9 SCHEDULE OF ABBREVIATIONS

A. Reference standards are listed in various sections using abbreviations contained below:

- AABC  Associated Air Balance Council
- ABMA  American Boiler Manufacturer Association
- ADC   Air Diffusion Council
- AGA   American Gas Association
- AIA   American Insurance Association
- AMCA  Air Movement and Control Association
- ANSI  American National Standards Institute
- ARI   Air Conditioning and Refrigeration Institute
- ASA   Acoustical Society of America
- ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
- ASME  American Society of Mechanical Engineers
- ASPE  American Society of Plumbing Engineers
- ASTM  American Society of Testing and Materials
- AWS   American Welding Society
- AWWA  American Water Work Association
- CTI   Cooling Tower Institute
- FM    Factory Mutual Engineering and Research
- IEEE  Institute of Electrical and Electronic Engineers
- IRI   Industrial Risk Insurers
- MSS   Manufacturers Standardization Society of the Valve and Fitting Industry
- MCAA  Mechanical Contractor's Association of America
- NEBB  National Environmental Balancing Bureau
- NBS   National Bureau of Standards
- NRCA  National Roofing Contractor's Association
- NEC   National Electrical Code
- NEMA  National Electrical Manufacturers Association
- NFPA  National Fire Protection Association
- NSF   National Sanitation Foundation
- OSHA  Occupation Safety and Health Administration
- PDI   Plumbing and Drainage Institute

1.10 ELECTRICAL, PLUMBING, AND CONTROL CHARACTERISTICS OF EQUIPMENT

A. The electrical, plumbing, and control characteristics of each item of equipment scheduled, noted and/or indicated on the plans and specifications are based on a particular manufacturer and model. While other manufacturers or models may be acceptable, it is the responsibility of the Contractor to verify that the electrical, plumbing, and controls characteristics for the equipment he proposes to provide match those indicated. In the instance where the equipment he proposes to provide has different electrical, plumbing, and controls characteristics, the Contractor AT NO COST TO THE OWNER shall provide the required electrical, plumbing, and controls characteristics required. All modifications to provide the electrical, plumbing, and control characteristics shall be coordinated by the Contractor with the Engineer.

B. Motor controllers, except where they are to be mounted inside a motor control center or specifically identified and scheduled in Division 26 or on the drawings, shall be furnished by the M/C or P/C for installation by the E/C. Refer to Section 220513 for details.

C. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.

D. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.

E. The date of acceptance by the Architect, for beneficial use by the Owner, shall be the beginning date of the warranty period.
1.11 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of each item of mechanical equipment shown on Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it shall be the responsibility of the Contractor to determine whether or not the equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared when required by the Architect to indicate a suitable arrangement.

B. Install equipment in a manner to permit access to all surfaces. Install valves, motors, drives, lubricating devices, filters, and other accessory items in a position to allow removal for service without requiring the disassembly of another part.

C. Large equipment or components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. The equipment shall be protected until all hazards of damage to the equipment are eliminated.

1.12 OPERATING AND MAINTENANCE MANUALS

A. Manuals shall be submitted which contain the following:

B. Description of the system provided.
   1. Handling, storage, and installation instructions.
   2. Detailed description of the function of each principal component of the systems or equipment, including necessary piping diagrams and valve identification charts.
   3. Operating procedures:
      a. Pre startup activities required.
      b. Startup.
      c. Normal operation.
      d. Emergency shutdown.
      e. Normal shutdown.
      f. Trouble-shooting guide.
   4. Maintenance:
      a. Complete lubrication requirements; type and source of lubricant, internal between lubrication, etc.
      b. Preventative and repair maintenance procedures.
      c. Complete spare parts list with cross reference to original equipment manufacturer part number.
   5. Control and alarm features:
      a. A schematic of all control systems.
      b. Control loop electric ladder diagrams and interlock diagrams.
      c. A list of all controller operating set points.
      d. A listing of all setting for alarms and shutdown system.
      e. Provide pump curves for all pumps.
      f. Provide fan curves for all fans.
   6. Safety and environmental considerations.
   7. Other data required elsewhere in the specifications.

C. Three copies of the manuals shall be provided within sufficient time to allow for training of Owner’s personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion or building turn over, whichever comes first. Submit the remaining three corrected copies within 15 days after review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

D. The requirements for manuals apply to each package and field-fabricated operating system.

E. The manuals shall be provided in three-ring side binders with durable plastic covers.

F. The manuals shall contain a detailed table of contents and have tab dividers for major sections and special equipment.
G. The Owner will not accept any training or equipment unless the maintenance manuals are received a minimum of 10 working days prior to request for Training/Turnover.

1.13 START-UP EQUIPMENT AND SYSTEMS

A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.

B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

1.14 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Architect to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorizes representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.

1.15 AS-BUILT DRAWINGS

A. The Contractor shall, during the progress of the job, keep a set of record prints on which he shall mark all changes. After completion of a CADD release form by the Contractor and near the conclusion of the job, the Architect will provide the Contractor with one set of AutoCAD electronic files of the Mechanical, Plumbing, and Electrical Drawings. The Contractor shall draft on these electronic files all changes made during the progress of the work and return them and one set of paper plans with the changes to the Architect as "As-Built Drawings".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Each item of equipment furnished on this project shall have local representation. Factory authorized service, and adequate stock of repair parts. "Local" shall be defined for this purpose as within 50 miles of the project site.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition: ASTM D 3138.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
   2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
   3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.


E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.
C. **Dielectric Unions:** Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. **Dielectric Flanges:** Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. **Dielectric Couplings:** Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. **Dielectric Nipples:** Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

### 2.6 MECHANICAL SLEEVE SEALS

A. **Description:** Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. **Available Manufacturers:**
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

2. **Sealing Elements:** EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. **Pressure Plates:** Carbon steel. Include two for each sealing element.

4. **Connecting Bolts and Nuts:** Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### 2.7 SLEEVES

A. **Galvanized-Steel Sheet:** 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. **Steel Pipe:** ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. **Stack Sleeve Fittings:** Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. **Underdeck Clamp:** Clamping ring with set screws.

D. **PVC Pipe:** ASTM D 1785, Schedule 40.

### 2.8 ESCUTCHEONS

A. **Description:** Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. **One-Piece, Deep-Pattern Type:** Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. **One-Piece, Cast-Brass Type:** With set screw.

1. **Finish:** Polished chrome-plated or rough brass.

D. **Split-Casting, Cast-Brass Type:** With concealed hinge and set screw.

1. **Finish:** Polished chrome-plated or rough brass.

E. **One-Piece, Stamped-Steel Type:** With set screw or spring clips and chrome-plated finish.

F. **Split-Plate, Stamped-Steel Type:** With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. **One-Piece, Floor-Plate Type:** Cast-iron floor plate.
H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.10 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials used for insulation, acoustical linings, adhesives, jackets and coatings, and combinations of these materials, shall each have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less, as determined by an independent testing laboratory in accordance with NFPA-255.

2.11 FIRESTOPPING

A. Provide firestopping in sealing of penetrations in fire-rated construction, horizontal and vertical, including the following materials:
1. Foam: Dow Corning Firestop silicone RTV foam, liquid component Part A (black) and liquid component Part B (off-white).
2. Sealant: 3M 1000NS and 1003SL silicone adhesive sealant, single component, neutral cure, and non-slumping.
3. Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by the applicator.
4. Pre-installed (firestop devices for use with noncombustible and/or combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors, the following products are acceptable:
   a. Hilti CP 680P or CP 680M Cast-In Place Firestop Devices:
      1) Add Aerator adapter when used in conjunction with an Aerator (Sovent system)
      2) Add metal deck adapter kit if utilizing CP 680P or M on corrugated metal deck.
      3) Add height extension if utilizing CP 680P or M in concrete slabs thicker than 8”.
      4) Add Hilti Water Module (2” up to 6”) to achieve UL W-Rating
      5) Add Hilti TOP SEAL (1/2” up to 2”) to achieve UL W-Rating
   b. Hilti CP 681 Tub Box Kit for use with bath tub installations.
   c. Hilti Toilet Flange for use with floor outlet water closets.
   d. Hilti coupling sleeve for use with floor, shower or general purposes drains.

5. Post installed (firestop devices for use with noncombustible and/or combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors, the following products are acceptable
   a. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants

B. Mixes shall conform to the manufacturer’s directions.

2.12 ACCESS PANELS AND DOORS

A. Provide wall and ceiling access doors for unrestricted access to concealed valves, dampers, and other mechanical equipment items and devices.

B. Access doors mounted in surfaces to be painted shall be Milcor Style "K" for plastered surfaces, and Style "M" for non-plastered surfaces. Style "K" doors shall be set with door flush with adjacent surfaces. Access doors mounted on tile surfaces shall be stainless steel and of similar construction to that described above. Access doors shall be not less than 12” x 12” in size.
PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed unless otherwise indicated on the Drawings.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Equipment to Be Removed: Disconnect and cap services and remove equipment.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. 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.

E. Disruptions: Maintain existing plumbing, heating, ventilating, air conditioning, fire protection, and other existing systems, and maintain all existing functions in service except for scheduled 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.

F. Scheduling of Disruption: Seek and obtain approval two weeks in advance of event for date, starting, and duration of each required disruption.

G. Notice of Disruption: Date, time and duration of each disruption shall be subject to the Owner's prior approval, and shall include the following information in the form of a memorandum submitted by the Contractor to the Architect for approval by the Owner:

<table>
<thead>
<tr>
<th>Facility/System</th>
<th>Starting Date</th>
<th>Starting Time</th>
<th>Duration</th>
</tr>
</thead>
</table>

H. 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.

I. Notification: Notify the Architect and the owner immediately, by telephone and then in writing, as changes and additions to the scheduled disruption requirements become known.

J. Duration: Complete as large a portion of the work as possible before initiating disruption and perform only that work necessary so as to minimize duration of disruption. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal service.

K. General:
   1. Modify remove, or relocate materials and items indicated on the Drawings or required by the installation of new facilities.
   2. Remove demolition materials from the site and deliver salvage materials to destinations on the premises, as directed.

L. 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 reserve 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 and to restore to good operating order.
5. Perform the relocation work in accordance with applicable Sections of the Specifications, utilizing skilled workers.

M. Relocating Devices: Remove and reinstall in locations designated by the Architect temperature control system devices, relays, piping, ductwork, equipment and other devices required for the operation of the various systems that are installed in existing-to-be-renovated construction.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
      b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to
2 inches above finished floor level. Refer to Division 07 Section “Sheet Metal Flashing and Trim” for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section “Joint Sealants” for materials and installation.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron “wall pipes” for sleeves 6 inches and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron “wall pipes” for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section “Penetration Firestopping” for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA’s “Copper Tube Handbook,” using lead-free solder alloy complying with ASTM B 32.


F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 “Quality Assurance” Article.
H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   5. PVC Nonpressure Piping: Join according to ASTM D 2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONSTRUCTION REQUIREMENTS

A. The Drawings and Specifications are intended to accomplish certain objectives. They show pipe and duct sizes, general routing and location, and describe the various systems. These documents describe and size equipment, its general location, usage, support and auxiliary requirements. They describe most, but not all of the materials and their usage for this project.

B. Contract Documents do not, however, detail certain job requirements. They do not show exact layouts, locations or elevations of ducts, expansion joints, anchors, sleeves, hangers, slots, holes, outlets, inserts,
elbows, fittings, thermometers, thermostats, gauges, wells, underfloor drains, sumps, or access doors. They do not show final precise locations of equipment by dimensions in most instances or manufacturer’s requirements for proper installation, operation and maintenance.

C. The exact location of each item shall be determined by reference to the project Contract Drawings, and to details, equipment drawings, and roughing-in drawings, by measurements at the building, and in cooperation with the various trades. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

D. Coordinate proper locations and sizes of slots, holes or openings in the building structure pertaining to this work, and for the correct location of sleeves. Place inserts to accommodate the ultimate installation of hangers in the forms, and set sleeves in forms before concrete is poured, and in masonry walls while they are under construction. Concealed lines shall be installed as required by the pace of the job to precede the general construction.

E. Study construction documents and lay out piping work carefully in advance of fabrication and erection, in order to meet the requirements of the extremely limited spaces. Where conflicts occur, work with all involved trades and resolve the conflict prior to erection of any work in the area involved.

3.7 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct minimum 3-1/2" concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit. Provide No. 3 bars at 2" – 0" o.c. each way.
   2. Install No. 3 dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."
   8. Chamfer corners of all housekeeping pads.
   9. Provide necessary foundations for exterior and interior equipment pads and confirm construction of required pads with structural engineer.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrainment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.11 EXCAVATION AND BACKFILL FOR PLUMBING WORK

A. Excavation

1. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that time lapse from excavation to completion of backfilling will be minimum.

2. Excavate with vertical sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.

3. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joists, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearances.

4. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate bottom cut to accurate elevations.

5. Depth for Subbase Support: For large piping (6" pipe size and larger), tanks, and where indicated for other mechanical work, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" below bottom of work to be supported.

6. Shoring and Bracing: Provide materials for shoring and bracing to comply with local codes and authorities having jurisdiction. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

7. Excavation for Trenches:
   a. Dig trenches to uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of piping.
   b. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
   c. Where rock is encountered, carry excavation 6" below required elevation and backfill with 6" layer of crushed stone or gravel prior to installation of pipe.
   d. For piping 5" or less in nominal size, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support piping on undisturbed soil.
   e. For piping 6" and larger in nominal size, tanks, and other mechanical work indicated to receive subbase, excavate to subbase depth indicated, or if not otherwise indicated, to below bottom of work to be supported.
   f. Grade bottoms of trenches as indicated, notching under piping couplings to provide solid bearing for entire body of piping.
   g. Depth for Exterior Piping: Except as otherwise indicated, excavate for exterior piping so that depth of cover shall be 18" minimum.
   h. Excavate near large trees (within drip line) by hand, and protect root system from damage or dryout to greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with asphaltic tree paint.
   i. Store excavated material (temporarily) near excavation, in manner that will not interfere with or damage excavation or other work. Do not store under trees (within drip line). Retain excavated material that complies with requirements for backfill material. Dispose of excavated material that is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material.
B. Backfill
1. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.
2. Backfill with finely-graded subbase material to 6” above wrapped, coated, and plastic piping and tanks, and to centerline of other tanks.
3. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.
4. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously; do not dislocate work from installed positions.
5. Backfill excavations in 8” high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D1557), using power-driven hand-operated compaction equipment.
6. Lawn and Landscaped Areas: 85% for cohesive soils; 90% for cohesionless soils.
7. Paved Areas Other Than Roadways: 90% for cohesive soils; 95% for cohesionless soils.
8. Roadways: 90% for cohesive soils; 95% for cohesionless soils.
9. Backfill to elevations matching adjacent grades, at a time of backfilling excavations for mechanical work.

C. Performance and Maintenance
1. Subsidence: Where subsidence is measurable or observable at mechanical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION
SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

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. Rubber expansion joints.
   2. Flexible-hose expansion joints.
   3. Pipe bends and loops.
   4. Alignment guides and anchors.

1.3 DEFINITIONS

A. BR: Butyl rubber.
B. Buna-N: Nitrile rubber.
C. CR: Chlorosulfonated polyethylene synthetic rubber.
D. CSM: Chlorosulfonated polyethylene rubber.
E. EPDM: Ethylene-propylene-diene terpolymer rubber.
F. NR: Natural rubber.

1.4 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
   2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
   3. Alignment Guide Details: Detail field assembly and attachment to building structure.
   4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.
PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

   1. Arch Type: Single or multiple arches.
   2. Spherical Type: Single or multiple spheres.
      a. Minimum Pressure and Temperature Ratings for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
      b. Minimum Pressure and Temperature Ratings for NPS 5 and NPS 6: 140 psig at 200 deg F.
      c. Minimum Pressure and Temperature Ratings for NPS 8 to NPS 12: 140 psig at 180 deg F.
   3. Material: BR.

B. Flexible-Hose Expansion Joints: Manufactured assembly with two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.
   1. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder-joint end connections.
      a. NPS 2 and Smaller: Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
      b. NPS 2-1/2 to NPS 4: Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

2.2 ALIGNMENT GUIDES

A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.3 MATERIALS FOR ANCHORS

A. Steel Shapes and Plates: ASTM A 36/A 36M.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
   2. Expansion Plug: Zinc-coated steel.

E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
   1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.

G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

B. Install expansion joints of sizes matching size of piping in which they are installed.

C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Attach pipe bends and loops to anchors.
   2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer’s written instructions.

3.3 SWING CONNECTIONS

A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 ALIGNMENT-GUIDE INSTALLATION

A. Install guides on piping adjoining pipe expansion fittings and loops.

B. Attach guides to pipe and secure to building structure.

3.5 ANCHOR INSTALLATION

A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.

D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.

E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION
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SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

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 RELATED SECTIONS

A. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.

B. Refer to Section 230519, “Meters and Gages for Piping Systems,” for required products on plumbing systems.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Bronze angle valves.
   2. Bronze ball valves.
   5. Bronze swing check valves.
   7. Iron swing check valves with closure control.
   8. Bronze gate valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.1 for power piping valves.
   3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
   4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
   5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Gate Valves: With rising stem.
   2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Grooved: With grooves according to AWWA C606.
   4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 150, Bronze Angle Valves with Nonmetallic Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. NIBCO INC.
      c. Powell Valves.
      d. Milwaukee.
2. **Description:**
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 300 psig.
   d. Ends: Threaded or solder.
   e. Stem: Bronze.
   f. Disc: TFE.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron.

2.3 **BRONZE BALL VALVES**

A. **Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:**
   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. NIBCO INC.
      c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      d. Apollo (manufactured by Conbraco).
      e. Milwaukee
   2. **Description:**
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends:
         1) Plumbing piping: Threaded or solder.
         2) Chilled-water piping: Threaded or Press-Fit
         3) Hot-water heating piping (max temperature of 160°F): Threaded or Press-Fit
         4) Hot-water heating piping (max temperature above 160°F): Threaded
      g. Seats: TFE.
      h. Stem: Stainless steel.
      i. Ball: Stainless steel, vented.
      j. Port: Full.

2.4 **IRON, SINGLE-FLANGE BUTTERFLY VALVES**

A. **200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:**
   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      a. NIBCO INC.
      b. Crane Co.
      c. Apollo (manufactured by Conbraco).
      d. Milwaukee
   2. **Description:**
      a. Standard: MSS SP-67, Type I.
      b. CWP Rating: 200 psig.
      c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
      d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
      e. Seat: EPDM.
      f. Stem: One- or two-piece stainless steel.
      g. Disc: Aluminum bronze or EPDM rubber encapsulated disc with polymer-coated body.

2.5 **HIGH-PERFORMANCE BUTTERFLY VALVES**

A. **Class 150, Single-Flange, High-Performance Butterfly Valves:**
   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. Crane Co.
      c. NIBCO INC.
      d. Milwaukee
2. Description:
   a. Standard: MSS SP-68.
   b. CWP Rating: 285 psig at 100 deg F.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
   e. Seat: Reinforced PTFE or metal.
   f. Stem: Stainless steel; offset from seat plane.
   g. Disc: Carbon steel.
   h. Service: Bidirectional.

2.6 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. NIBCO INC.
      c. Apollo (manufactured by Conbraco).
      d. Milwaukee
   2. Description:
      a. Standard: MSS SP-80, Type 4.
      b. CWP Rating: 300 psig.
      c. Body Design: Horizontal flow.
      e. Ends: Threaded.
      f. Disc: TFE.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. NIBCO INC.
      c. Powell Valves.
      d. Apollo (manufactured by Conbraco).
      e. Milwaukee
   2. Description:
      a. Standard: MSS SP-71, Type I.
      b. CWP Rating: 200 psig.
      c. Body Design: Clear or full waterway.
      d. Body Material: ASTM A 126, gray iron with bolted bonnet.
      e. Ends: Flanged.
      f. Trim: Bronze. (Renewable and regrindable disc.)
      g. Gasket: Asbestos free.

2.8 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. NIBCO INC.
      b. Crane.
      c. Powell.
      d. Apollo (manufactured by Conbraco).
      e. Milwaukee
   2. Description:
      a. Standard: MSS SP-71, Type I.
      b. CWP Rating: 200 psig.
      c. Body Design: Clear or full waterway.
      d. Body Material: ASTM A 126, gray iron with bolted bonnet.
      e. Ends: Flanged.
      f. Trim: Bronze. (Renewable and regrindable disc.)
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and spring.

2.9 BRONZE GATE VALVES

A. Class 150, RS Bronze Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. NIBCO INC.
      c. Powell Valves.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      e. Apollo (manufactured by Conbraco).
      f. Milwaukee
   2. Description:
      a. Standard: MSS SP-80, Type 2.
      b. CWP Rating: 300 psig.
      d. Ends: Threaded or solder.
      e. Stem: Bronze.
      f. Disc: Solid wedge; bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron.

2.10 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. NIBCO INC.
      c. Powell Valves.
      d. Apollo (manufactured by Conbraco).
      e. Milwaukee
   2. Description:
      a. Standard: MSS SP-70, Type I.
      b. CWP Rating: 200 psig.
      c. Body Material: ASTM A 126, gray iron with bolted bonnet.
      d. Ends: Flanged.
      e. Trim: Bronze.
      f. Disc: Solid wedge.
      g. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.
      b. NIBCO INC.
      c. Powell Valves.
      d. Apollo (manufactured by Conbraco).
      e. Milwaukee
   2. Description:
      a. Standard: MSS SP-70, Type I.
      b. CWP Rating: 500 psig.
      c. Body Material: ASTM A 126, gray iron with bolted bonnet.
      d. Ends: Flanged.
      e. Trim: Bronze.
      f. Disc: Solid wedge.
      g. Packing and Gasket: Asbestos free.

2.11 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.
b. NIBCO INC.
c. Apollo (manufactured by Conbraco).
d. Powell Valves.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Milwaukee

2. Description:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 300 psig.
   d. Ends: Threaded or solder.
   e. Stem: Bronze.
   f. Disc: TFE.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
   B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
   C. Examine threads on valve and mating pipe for form and cleanliness.
   D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
   E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION
   A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
   B. Locate valves for easy access and provide separate support where necessary.
   C. Install valves in horizontal piping with stem at or above center of pipe.
   D. Install valves in position to allow full stem movement.
   E. Install three (3) chainwheels on operators for butterfly and gate valves NPS 3 and larger and more than 72 inches above floor. Extend chains to 60 inches above finished floor.
   F. Install check valves for proper direction of flow and as follows:
      1. Swing Check Valves: In horizontal position with hinge pin level.
      2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING
   A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.
3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly, gate, or plug valves.
3. Throttling Service except steam: Globe, angle, or butterfly valves.
4. Pump-Discharge Check Valves:
   a. NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc.
   b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.
   c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Steel Piping except steam and steam condensate: Valve ends may be grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, nonmetallic disc.
4. Bronze Gate Valves: Class 150.

B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 150, nonmetallic disc.
3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
5. Bronze Gate Valves: Class 150, RS.

B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
4. Iron Swing Check Valves: Class 125, metal seats.
5. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
6. Iron Gate Valves: Class 125, OS&Y.
3.7 CHILLED-WATER, HOT WATER AND CONDENSER WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 150, nonmetallic disc.
3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
5. Bronze Gate Valves: Class 150, RS, bronze.

B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
5. Iron Swing Check Valves: Class 125, metal seats.
6. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
7. Iron Gate Valves: Class 125, OS&Y.

3.8 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
3. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.

3.9 HIGH-PRESSURE STEAM VALVE SCHEDULE (MORE THAN 15 PSIG)

A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.

B. Pipe Sizes NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.

3.10 STEAM-CONDENSATE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
3.11 VALVES, GENERAL

A. Each valve shall be appropriately rated, as to pressure and temperature, for the fluid being handled by the system and for the operating pressure anticipated at the valve location.

B. Where ball valves, plug valves and butterfly valves are installed in piping to be insulated, provide extended type operators/stems to points beyond the exterior surface of the insulation.

C. Provide chain operators on gate valves and butterfly valves 3-inch and larger mounted higher than six (6) feet above the floor.

D. Valve Standardization: Valves from one or more manufacturers may be used, however valves supplied for each specific valve type shall be the product of one manufacturer.

E. Valves shall be first quality, free from all imperfections and defects, with body markings indicating manufacturer and rating.

F. Valve parts of same manufacturer, size and type shall be interchangeable.

G. Manually operated gate, globe and angle valves shall be of rising stem type, unless otherwise specified.

H. Manually operated valves shall open in a counterclockwise direction by means of round ventilated type handwheels.
   1. Exception: Cross handle type handwheels are acceptable for valves up to 2 inches in size.

I. In open position, wedge and stem of gate valves shall clear the waterway completely.

J. Valves that use packing shall be capable of being packed when wide open and under full working pressure.

K. All valves that use packing shall utilize non-asbestos materials.

L. Size valves the same size as the piping in which they are installed, unless otherwise specified.

END OF SECTION
SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. This Section includes the following hangers and supports for plumbing system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
   3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
   4. Division 22 Section "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Pipe positioning systems.

1.6 QUALITY ASSURANCE


B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

**PART 2 - PRODUCTS**

**2.1 STEEL PIPE HANGERS AND SUPPORTS**

A. **Description:** MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. **Galvanized, Metallic Coatings:** Pregalvanized or hot dipped.

C. **Nonmetallic Coatings:** Plastic coating, jacket, or liner.

D. **Padded Hangers:** Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

**2.2 TRAPEZE PIPE HANGERS**

A. **Description:** MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

**2.3 METAL FRAMING SYSTEMS**

A. **Description:** MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. **Coatings:** Manufacturer's standard finish unless bare metal surfaces are indicated.

C. **Nonmetallic Coatings:** Plastic coating, jacket, or liner.

**2.4 THERMAL-HANGER SHIELD INSERTS**

A. **Description:** 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. **Insulation-Insert Material:** Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. **For Trapeze or Clamped Systems:** Insert and shield shall cover entire circumference of pipe.

D. **For Clevis or Band Hangers:** Insert and shield shall cover lower 180 degrees of pipe.

E. **Insert Length:** Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

**2.5 FASTENER SYSTEMS**

A. **Powder-Actuated Fasteners:** Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. **Mechanical-Expansion Anchors:** Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

**2.6 MISCELLANEOUS MATERIALS**

A. **Structural Steel:** ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
B. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.7 ROOF PIPING SUPPORTS

A. Piping located on roofs shall be supported using devices with polypropylene or polycarbonate bases. The bases shall have integral cradles to support piping, or roller devices as called for on the drawings. The quantity and size of supports shall be such that the weight on the roofing membrane shall not exceed 2 psi.

B. Roof supports shall be manufactured by Miro Industries or PHP Systems/Design.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use copper-plated hangers and supports or nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
   8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

P. Select size of hangers and supports to exactly fit pipe size and insulation.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping. All hangers on domestic water and hydronic piping shall be installed on the exterior of the pipe insulation.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Provide pipe hangers at every elbow and any change in direction per MSS-SP-58.


K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Hangers shall be installed on the exterior of pipe insulation. Use thermal-hanger shield insert with clamp sized to match OD of insert.
      b. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

8. Hangers for cold piping shall be placed around the outside of the insulation/vapor barrier or insulation must completely cover the hanger and rod.

Q. Do not use wire or perforated metal to support piping, and do not support piping from other pipes.

R. Support fire protection piping independently from other piping.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 INSTALLATION OF ROOF SUPPORTS

A. Install pre-manufactured pipe supports to elevate piping to a height indicated on the drawings. The maximum load across the base of supports shall not exceed 2 psi. Support piping so it is level along the full length.
3.7 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 220548 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

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.

B. Refer to Vibration Controls for HVAC Piping and Equipment, Section 230548, for plumbing vibration controls.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
   2. Pipe labels.
   3. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   5. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
2. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

A. Valve Tags: Stainless Steel or Brass labels for mechanical engraving and having chain for attachment to valve.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals in areas of congested piping and equipment.

B. Pipe Label Color:
   1. Provide labels of standard accepted color schemes for each plumbing and mechanical system on the project.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Identify valve locations above ceilings with red 1/2" square or round press-tape markers at ceiling access panels.

END OF SECTION
SECTION 220700 - PLUMBING INSULATION

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. Insulation Materials:
      a. Flexible elastomeric
      b. Mineral fiber.
   2. Factory-applied jackets.
   3. Field-applied jackets.

B. Related Sections include the following:
   1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:
   1. Product Data for Credit IEQ-Low-Emitting Materials: For adhesives and sealants, including printed statement of VOC content.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and
maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials (0.25Btu in/h ft2 at 75 degrees F).

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000(Pipe Insulation.
   c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ (0.24 Btu in/h ft2 at 75 degrees F). Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.3 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville; Zeston.
      c. Proto PVC Corporation; LoSmoke.
   2. Color: Refer to color chart on Plumbing Notes sheet per UNT Guidelines.
   3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
   4. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; Metal Jacketing Systems.
      b. PABCO Metals Corporation; Surefit.
      c. RPR Products, Inc.; Insul-Mate.
      a. Sheet and roll stock ready for shop or field sizing.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      e. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
      1. Verify that systems and equipment to be insulated have been tested and are free of defects.
      2. Verify that surfaces to be insulated are clean and dry.
      3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
   A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
   B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
      1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.
2. Provide UL-approved assemblies.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
   4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
   5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are required, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.
B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified on Plumbing sheets as UNT Guidelines.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Do not field paint aluminum or stainless-steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold and Non-Circulated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Circulated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Stormwater and Overflow:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
D. Roof Drain and Overflow Drain Bodies:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Condensate and Equipment Drain Water:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

H. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

I. Below Grade Domestic Hot Water:
   1. All Pipe Sizes: Insulation shall be:

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

D. Hot Service Drains:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Hot Service Vents:
   1. All Pipe Sizes: Insulation shall be:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch thick.

3.13 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Exposed, up to 48 inches in Diameter or with Flat Surfaces up to 72 Inches:
   1. PVC, Color by UNT Guidelines, 20 mils thick.
D. Indoor Piping, Exposed:
   1. PVC, Color by UNT Guidelines, 20 mils thick.

E. Exterior Piping, Exposed:
   1. Aluminum, Corrugated: 0.032 inch thick.

3.14 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION
SECTION 221116 - DOMESTIC WATER PIPING

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. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
   2. Specialty valves.
   3. Flexible connectors.
   5. Escutcheons.
   6. Sleeves and sleeve seals.
   7. Wall penetration systems.

1.3 SUBMITTALS

A. Product Data: For the following products:
   1. Specialty valves.
   2. Dielectric fittings.
   3. Flexible connectors.
   4. Backflow preventers and vacuum breakers.
   5. Escutcheons.
   6. Sleeves and sleeve seals.

B. LEED Submittal:
   1. Product Data for Credit IEQ-Low-Emitting Materials: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Shop Drawings: Detail, at 1/4" = 1'-0" scale, the major overhead piping layout, locations of valves and other pieces of equipment, elevation of piping, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints, attachments of the same to building structure, equipment supports and foundations, underground piping layout. Out-of-scale drawings showing actual dimensions will not be acceptable. Shop drawings shall show coordination with all other building trades.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
   2. Do not proceed with interruption of water service without Architect's written permission.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.
PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88 water tube, drawn temper.
   4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
   5. Copper Pressure-Seed-Joint Fittings:
      a. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
      b. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

B. Soft Copper Tube: ASTM B 88 water tube, annealed temper.
   2. Copper Pressure-Seed-Joint Fittings:
      a. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
      b. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, Grade Sb-5, lead-free alloys. Include water-flushable flux according to ASTM B 813. 95% tin/5% antimony solid, string or wire type (cored solder will not be allowed).

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 PEX TUBE AND FITTINGS

A. Uponor PEX piping for domestic cold/hot water use. **NO EXCEPTIONS** on manufacturer.

B. Tube Material: PEX plastic according to ASTM 876.

C. Fittings: ASTM F 1960, cold expansion fittings and reinforcing rings.

2.5 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Description:
      a. Pressure Rating: 150 psig at 180 deg F.
      b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Description:
      a. Factory-fabricated, bolted, companion-flange assembly.
      b. Pressure Rating: 150 psig.
      c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.7 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
   2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
   3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.8 WATER METERS

A. Displacement-Type Water Meters:
   1. Description:
      b. Pressure Rating: 150-psig working pressure.
      c. Body Design: Nutating disc; totalization meter.
      d. Registration: In gallons or cubic feet as required by utility.
      e. Case: Bronze.
      f. End Connections: Threaded.
      g. Control: Provide connection to BMS.

2.9 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

C. Split Plate, Stamped Steel: Chrome-plated finish with hinge, setscrew.

D. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

A. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.11 WALL PENETRATION SYSTEMS

A. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
   1. Carrier-Pipe Deflection: Up to 5 percent without leakage.
   2. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
   3. Housing-to-Sleeve Gasket: EPDM rubber.
   5. Pipe Sleeve: AWWA C151, ductile-iron pipe.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 22 Section “Common Work Results for Plumbing” and Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA’s "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

F. Install domestic water piping level and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.
N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

Q. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

S. Install PEX tubing with a loop at each change of direction more than 90 degrees.

T. Joints for PEX Tubing: Join according to ASTM F 1960 for cold expansion fittings and reinforcing rings.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   4. NPS 2-1/2: 108 inches with 1/2-inch rod.
   5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
   6. NPS 6: 10 feet with 5/8-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. **Install vinyl coated hangers for PEX tubing at a maximum horizontal spacing of 32 inches.**

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer’s written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

C. Install sleeves in new partitions, slabs, and walls as they are built.

D. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section “Joint Sealants” for joint sealants.

E. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section “Joint Sealants” for joint sealants.

F. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.

G. Seal space outside of sleeves in concrete slabs and walls with grout.
H. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

I. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Report leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

C. Domestic water piping will be considered defective if it does not pass tests and inspections.

D. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.10 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow:
      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets, or for four (4) hours minimum.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets, or for four (4) hours minimum.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Compile and maintain cleaning reports and make available to the AHJ, owner, architect and engineer as needed.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building service piping, NPS 4 and smaller, shall be the following:
1. Soft copper tube, ASTM B 88, Type K wrought-copper solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 4 and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type L; wrought- copper solder-joint fittings; and soldered joints.
   a. Per UNT Design Guidelines, mechanical joints are preferred.
2. For piping NPS 2 and below the contractor may use PEX tubing with ASTM F 1960 cold expansion fittings and reinforcing rings. PEX is not allowed on vertical risers, only horizontal runs. Refer to insulation requirements on drawings/specifications, per IECC 2015, all PEX piping (hot and cold) is still required to be insulated the same as copper.
3.13 SCHEDULE OF BRANCHES

A. The sizes of branches or runouts to each fixture shall be as indicated on the drawings. Where no size of connection is indicated, connections shall be no smaller than those indicated in the following schedule:

<table>
<thead>
<tr>
<th>FIXTURE</th>
<th>COLD WATER</th>
<th>HOT WATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Closets</td>
<td>1&quot;</td>
<td>---</td>
</tr>
<tr>
<td>Lavatories</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Urinals</td>
<td>3/4&quot;</td>
<td>---</td>
</tr>
<tr>
<td>Sinks</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Service Sinks</td>
<td>3/4&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>Hose Bibbs</td>
<td>3/4&quot;</td>
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</tr>
<tr>
<td>Box Hydrants</td>
<td>3/4&quot;</td>
<td>---</td>
</tr>
<tr>
<td>Elec. Water Cooler</td>
<td>1/2&quot;</td>
<td>---</td>
</tr>
<tr>
<td>Showers</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
</tr>
</tbody>
</table>

3.14 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
   2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION
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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Backflow preventers.
   5. Temperature-actuated water mixing valves.
   7. Hose bibbs.
   8. Wall hydrants.
  10. Trap-seal primer valves.

B. Related Sections include the following:
   1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
   2. Division 22 Section "Domestic Water Piping" for water meters.

1.3 PERFORMANCE REQUIREMENTS
A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS
A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS
A. Vacuum Breakers:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Watts Industries, Inc.; Water Products Div. – Model No. 288-AC.
      b. Conbraco Industries, Inc.
      c. MIFAB, Inc.
      d. Woodford Manufacturing Company.
      e. Zurn Plumbing Products Group
3. Finish: Chrome plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Ames Co.
      b. Conbraco Industries, Inc.
      c. FEBCO; SPX Valves & Controls.
      e. Zurn Plumbing Products Group
   3. Operation: Continuous-pressure applications.
   4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
   5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   7. Accessories:
      a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

B. Double-Check Backflow-Prevention Assemblies:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Ames Co.
      b. Conbraco Industries, Inc.
      c. FEBCO; SPX Valves & Controls.
      e. Zurn Plumbing Products Group; Wilkins Div.
   3. Operation: Continuous-pressure applications, unless otherwise indicated.
   4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
   5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   7. Accessories:
      a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cash Acme.
      b. Conbraco Industries, Inc.
      c. Honeywell Water Controls.
      e. Zurn Plumbing Products Group; Wilkins Div.
   4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.
2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      b. Flo Fab Inc.
      c. ITT Industries; Bell & Gossett Div.
      d. NIBCO INC.
      e. TAC Americas.
      f. Taco, Inc.
      g. Watts Industries, Inc.; Water Products Div.
   2. Type: Y-pattern globe valve with two readout ports and memory setting indicator.
   3. Body: Bronze,
   4. Size: Same as connected piping, but not larger than NPS 2.
   5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      b. Cash Acme.
      c. Conbraco Industries, Inc.
      d. Leonard Valve Company.
      e. Powers; a Watts Industries Co.
      f. Symmons Industries, Inc.
      g. Taco, Inc.
      h. Watts Industries, Inc.; Water Products Div.
      i. Zurn Plumbing Products Group; Wilkins Div.
   4. Type: Thermostatically controlled water mixing valve.
   5. Material: Bronze body with corrosion-resistant interior components.
   6. Connections: Threaded union inlets and outlet.
   7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
   8. Valve Finish: Rough bronze.

B. Manifold, Thermostatic, Water-Mixing-Valve Assemblies:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Leonard Valve Company.
      b. Powers; a Watts Industries Co.
      c. Symmons Industries, Inc.
   2. Description: Factory-fabricated, cabinet-type, thermostatically controlled, water-mixing-valve assembly in two-valve parallel arrangement.
   3. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
   5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
   6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
   7. Component Pressure Ratings: 125 psig minimum, unless otherwise indicated.
   8. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.
2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
   2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
   3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   4. Screen: Stainless steel with round perforations, unless otherwise indicated.
   5. Perforation Size:
      a. Strainers NPS 3 and Smaller: 0.062 inch.
      b. Strainers NPS 4 and larger: 0.125 inch.
   7. Schedule: Mueller #352 for 150 psig and less.

2.7 HOSE BIBBS

A. Hose Bibbs:
   4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
   5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
   8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
   10. Finish for Finished Rooms: Chrome or nickel plated.
   11. Include operating key with each operating-key hose bibb.
   12. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      b. Josam Company.
      c. MIFAB, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products Inc.
      g. Zum Plumbing Products Group; Specification Drainage Operation.
   4. Operation: Loose key.
   5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   6. Inlet: NPS 3/4 or NPS 1.
   7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   8. Box: Deep, flush mounting with cover.
   12. Operating Keys(s): One with each wall hydrant.

2.9 GROUND HYDRANTS

A. Nonfreeze Ground Hydrants:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Josam Company.
   c. MIFAB, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zum Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M.

3. Type: Nonfreeze, concealed-outlet ground hydrant with box.

4. Operation: Loose key.

5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.


8. Drain: Designed with hole to drain into ground when shut off.


11. Operating Key(s): One with each ground hydrant.


2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. PPP Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products Inc.
   i. Zum Plumbing Products Group; Specification Drainage Operation.


3. Type: Copper tube with piston.

4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. MIFAB, Inc.
   c. PPP Inc.
   d. Sioux Chief Manufacturing Company, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.


5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
   3. Do not install bypass piping around backflow preventers.
   4. Install between 3'-0" and 5'-0" above finished floor.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

H. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with 12" x 12" x 6" concrete pad. Provide a backflow preventer in piping supplying each hydrant.

I. Install water hammer arresters in water piping according to PDI-WH 201.

J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.
C. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION
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SECTION 221316 - SANITARY WASTE, STORM DRAINAGE AND VENT PIPING

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. This Section includes the following for soil, waste, and vent piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

B. Related Sections include the following:
   1. Division 22 Section “Sump Pumps.”

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
   2. Storm drainage piping: 10-foot head of water (30 kPa).
   3. Storm drainage, force-main piping: 50 psig (345 kPa).

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. LEED Submittal:
   1. Product Data for Credit IEQ-Low-Emitting Materials: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Shop Drawings:
   1. Detail, at 1/4” = 1'-0”, the major overhead piping layout, locations of drains and cleanouts, elevation of piping, equipment supports and foundations, underground piping layout. Out-of-scale drawings showing actual dimensions will not be acceptable. Shop drawings shall show coordination with all other building trades.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, “Plastics Piping Systems Components and Related Materials,” for plastic piping components. Include marking with “NSF-dwv” for plastic drain, waste, and vent piping; “NSF-drain” for plastic drain piping; “NSF-tubular” for plastic continuous waste piping; and “NSF-sewer” for plastic sewer piping.

C. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed with NSF International.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 “Piping Applications” Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).
B. Gaskets: ASTM C 564, rubber.
C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.
B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield, stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall Schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.
   1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
   2. Pipe and fittings in paragraph and subparagraph below are available in NPS 3 to NPS 12 (DN 80 to DN 300).
B. Solvent Cement and Adhesive Primer:
   1. Use PVC solvent cement, ASTM D 2564, that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use adhesive primer, ASTM F 656, that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
C. PVC piping shall not be installed in a return air plenum.
D. PVC sewer piping and fittings if allowed by the UNT AHJ and only allow below grade.

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Sleeve Materials:
      b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.7 FOUNDATION AND BELOW FLOOR PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:
   1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated; for coupled joints.
   2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP, or AASHTO M 294, Type CP; corrugated; for coupled joints.
   3. Couplings: Manufacturer’s standard, band type.
   4. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent unless otherwise indicated.

B. Encase pipe with PP or polyester fibers or combination of both, sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

C. Refer to Section 334600 for additional information.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" and Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping (all sizes) shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard couplings; and hubless-coupling joints.

C. Aboveground, vent piping, all sizes, shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard couplings and hubless-coupling joints.

D. Underground, soil, waste, and vent piping, all sizes, shall be any of the following:
   1. Service weight, cast-iron soil piping; gaskets; and gasketed joints.
   2. Solid-wall SCH 40 PVC pipe and fittings. (*except where noted on the drawings*)

E. Aboveground storm drainage piping (all sizes), shall be any of the following:
   1. Hubless cast iron soil pipe and fittings; standard, shielded stainless steel couplings, and coupled joints.

F. Underground storm drainage piping (all sizes) shall be any of the following:
   1. Service weight, cast iron soil pipe and fittings; gaskets and gasketed joints.
   2. Solid-wall SCH 40 PVC pipe and fittings.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary and storm sewers as indicated, and:
   1. As required by the plumbing code.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.
Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install wall-penetration fittings at each service pipe penetration through foundation wall. Make installation watertight.

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A 74 or AWWA C105.

F. Make changes in direction for soil, storm and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer’s written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install storm soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Building Sanitary Drain and Horizontal Sanitary Drainage Piping: 1/4" per foot where possible, and not less than 1/8" per foot.
   2. Vent Piping: 1/8" per foot down toward vertical fixture vent or toward vent stack.
   3. Building Storm Drain and Horizontal Storm Drain Piping: 1/8" per foot in direction of flow.

I. All underground piping will have a minimum earth cover of 36" to the top of the pipe.

J. All underground piping systems will have a #12 AWG copper wire attached to the pipe for a tracing wire. Wire is to be labeled and terminated in an accessible location. No splicing of wire is allowed. This is required by UNT Guidelines.

K. Labeled and terminated in an accessible location. No splices in wire allowed.

L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Install PVC storm, soil and waste drainage and vent piping according to ASTM D 2665.

N. Install underground PVC storm, soil and waste drainage piping according to ASTM D 2321.

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."


C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

F. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2855.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
   1. Install gate or full-port ball valve for piping NPS 2 and smaller.
   2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
   1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
   2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
   3. Install backwater valves in accessible locations.
   4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Install individual, straight, horizontal piping runs according to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
   4. NPS 6: 60 inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 72 inches with 3/8-inch rod.
   2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
   2. NPS 3: 48 inches with 1/2-inch rod.
   3. NPS 4 and 5: 48 inches with 5/8-inch rod.
   4. NPS 6: 48 inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

J. Install supports for vertical PVC piping every 48 inches.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary and storm drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow,
but not less than 10-foot head of water. From 4 hours before inspection starts or more to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

E. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 SCHEDULE OF BRANCHES

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<tr>
<th>FIXTURE</th>
<th>WASTE</th>
<th>VENT</th>
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<th>HOT WATER</th>
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SECTION 221319 - SANITARY WASTE AND STORM DRAINAGE PIPING SPECIALTIES

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. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves.
   2. Cleanouts.
   3. Floor drains.
   4. Channel drainage systems.
   5. Interceptors.
   6. Roof drains.
   7. Conductor nozzles.

1.3 DEFINITIONS

B. FRP: Fiberglass-reinforced plastic.
C. HDPE: High-density polyethylene plastic.
D. PE: Polyethylene plastic.
E. PP: Polypropylene plastic.
F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
   1. Floor drains and sanitary waste accessories.
   2. Interceptors.
   3. Storm drainage accessories.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate size and location of roof penetrations.
PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
   2. Size: Same as connected piping.
   4. Cover: Cast iron with threaded access check valve.
   5. End Connections: Hub and spigot or hubless.
   6. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
   7. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:
   1. Size: Same as floor drain outlet.
   2. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
   3. Check Valve: Removable ball float.
   4. Inlet: Threaded.
   5. Outlet: Threaded or spigot.

C. Horizontal, Plastic Backwater Valves:
   1. Size: Same as connected piping.
   2. Body: PVC.
   3. Cover: Same material as body with threaded access to check valve.
   4. Check Valve: Removable swing check.
   5. End Connections: Socket type.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:
   1. Standard: ASME A112.36.2M for cast iron.
   2. Size: Same as connected drainage piping
   5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts
   1. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
   2. Size: Same as connected branch.
   3. Type: Threaded, adjustable housing.
   4. Body or Ferrule: Cast iron.
   5. Closure: Brass plug with straight threads and gasket, Plastic plug.
   7. Frame and Cover Shape: Round.
   8. Top Loading Classification: Medium Duty.

C. Cast-Iron Wall Cleanouts:
   1. Standard: ASME A112.36.2M. Include wall access.
   2. Size: Same as connected drainage piping.
   3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
4. Refer to the schedule on the Drawings for further requirements regarding strainers, finishes, backwater valves, sediment buckets, loading, funnels and trap primers. All drains shall be fully adjustable and have deep seal traps.

B. Trap Guards:
1. Pre-manufactured devices inserted in the floor drain or opening to prevent sewer gases from entering the space or backwater.
2. Device is constructed of elastomeric material that bends and opens to allow water to flow through it and closes when there is no water flow.
3. ProVent Systems, Inc. "trapguard" or equal.

2.4 CHANNEL DRAINAGE SYSTEMS

A. Polymer-Concrete Channel Drainage Systems:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ABT, Inc.
   b. ACO Polymer Products, Inc.
   c. Forte Composites, Inc.
   d. Josam Company; Mea-Josam Div.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Watts Drainage Products Inc.
2. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
   a. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
      1) Dimensions: 4-inch inside width. Include number of units required to form total lengths indicated.
      2) Frame: Gray-iron or galvanized steel for grates.
   b. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.
      1) Material: Cast iron.
      2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
   c. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
   d. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.5 INTERCEPTORS

A. Grease, Oil, and Solids Interceptors:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Plumbing and Drainage Institute Seal: Required.
4. Body Material: Cast iron or steel.
5. Interior Lining: Corrosion-resistant enamel.
7. Refer to schedule on Drawings for size, capacity, flow rate and mounting details for each type of interceptor.

2.6 ROOF DRAINS

A. Metal Roof Drains:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.21.2M.
   3. Pattern: Roof drain.
   5. Combination Flashing Ring and Gravel Stop: Required.
   6. Outlet: Bottom.
   7. Dome Material: Cast iron.
   8. Extension Collars: Required.
  10. Sump Receiver: Required.

2.7 MOTORS

A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

2.8 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Boots:
   1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
   2. Size: Inlet size to match downspout.
   3. Description: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.
   4. Size: Same as or larger than connected downspout.

B. Conductor Nozzles:
   1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
   2. Size: Same as connected conductor.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Anchor interceptors to concrete bases.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
   2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.
   5. Confirm all locations with Architect prior to installation.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Where cleanouts occur flush with floor, they shall be designed for the type and finish of floor material. Confirm floor finish with Architect prior to installation.

G. Cleanout coverplates shall be attached with vandal-proof screws.

H. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

I. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

J. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

L. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
M. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

N. Assemble open drain fittings and install with top of hub 2 inches above floor.

O. Install deep-seal traps on floor drains and other waste outlets, if indicated.

P. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

Q. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

R. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

S. Install vent caps on each vent pipe passing through roof.

T. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

U. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

V. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

W. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
   2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
   3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
   4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

X. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing. Coordinate oil-interceptor storage tank and gravity drain with Division 23 Section "Facility Fuel-Oil Piping."

Y. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

Z. Install wood-blocking reinforcement for wall-mounting-type specialties.

AA. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

BB. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

CC. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
   1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Position roof drains for easy access and maintenance.

DD. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

EE. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
FF. Install manufactured, gray-iron downspout boots at grade with top 6 inches above grade. Secure to building wall.

GG. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

D. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION
SECTION 230500 - COMMON WORK RESULTS FOR HVAC

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. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Mechanical sleeve seals.
   5. Sleeves.
   7. Grout.
   8. HVAC demolition.
   9. Equipment installation requirements common to equipment sections.
   10. Painting and finishing.
   11. Concrete bases.
   12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
   1. CPVC: Chlorinated polyvinyl chloride plastic.
   2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.
B. In order to make the submittal review process more efficient for all parties, all MEP submittal data and shop drawings shall be reviewed on a designated “Submittal Review Day”. The “Submittal Review Day” will consist of having the Engineer, General Contractor, Electrical Contractor, and Mechanical HVAC Contractor review the submittals together, in the same room. The Architect and Owner’s representative(s) will be invited to attend the “Submittal Review Day”. Key Manufacturer’s Representatives shall attend the review or be available by phone for immediate response to questions and/or comments. All submittals will be reviewed and stamped by the Engineer the same day. The Contractor is responsible for setting time and place for this review and inviting all required parties. All parties shall be given a minimum of 7 days notice prior to submittal review day.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”

1.8 GENERAL

A. For Products specified by reference to an association or trade standard, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

B. The date of the standard is that in effect on the date of issue of Contract Documents, except when a specific publication date is specified. Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

1.9 SCHEDULE OF ABBREVIATIONS

A. Reference standards are listed in various sections using abbreviations contained below:
   AABC Associated Air Balance Council
1.10 ELECTRICAL, PLUMBING, AND CONTROL CHARACTERISTICS OF EQUIPMENT

A. The electrical, plumbing, and control characteristics of each item of equipment scheduled, noted and/or indicated on the plans and specifications are based on a particular manufacturer and model. While other manufacturers or models may be acceptable, it is the responsibility of the Contractor to verify that the electrical, plumbing, and controls characteristics for the equipment he proposes to provide match those indicated. In the instance where the equipment he proposes to provide has different electrical, plumbing, and controls characteristics, the Contractor AT NO COST TO THE OWNER shall provide the required electrical, plumbing, and controls characteristics required. All modifications to provide the electrical, plumbing, and control characteristics shall be coordinated by the Contractor with the Engineer.

B. Motor controllers, except where they are to be mounted inside a motor control center or specifically identified and scheduled in Division 26 or on the drawings, shall be furnished by the M/C or P/C for installation by the E/C. Refer to Section 220513 for details.

C. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.

D. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.

E. The date of acceptance by the Architect, for beneficial use by the Owner, shall be the beginning date of the warranty period.

1.11 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of each item of mechanical equipment shown on Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it shall be the responsibility of the
Contractor to determine whether or not the equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared when required by the Architect to indicate a suitable arrangement.

B. Install equipment in a manner to permit access to all surfaces. Install valves, motors, drives, lubricating devices, filters, and other accessory items in a position to allow removal for service without requiring the disassembly of another part.

C. Large equipment or components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. The equipment shall be protected until all hazards of damage to the equipment are eliminated.

1.12 OPERATING AND MAINTENANCE MANUALS

A. Manuals shall be submitted which contain the following:
   1. Description of the system provided:
      a. Handling, storage, and installation instructions.
      b. Detailed description of the function of each principal component of the systems or equipment, including necessary piping diagrams and valve identification charts.
   2. Operating procedures:
      a. Pre startup activities required.
      b. Startup.
      c. Normal operation.
      d. Emergency shutdown.
      e. Normal shutdown.
      f. Trouble-shooting guide.
   3. Maintenance:
      a. Complete lubrication requirements; type and source of lubricant, internal between lubrication, etc.
      b. Preventative and repair maintenance procedures.
      c. Complete spare parts list with cross reference to original equipment manufacturer part number.
   4. Control and alarm features:
      a. A schematic of all control systems.
      b. Control loop electric ladder diagrams and interlock diagrams.
      c. A list of all controller operating set points.
      d. A listing of all setting for alarms and shutdown system.
      e. Provide pump curves for all pumps.
      f. Provide fan curves for all fans.
   5. Safety and environmental considerations.
   6. Other data required elsewhere in the specifications.

B. Three copies of the manuals shall be provided within sufficient time to allow for training of Owner's personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion or building turnover, whichever comes first. Submit the remaining three corrected copies within 15 days after review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

C. The requirements for manuals apply to each package and field-fabricated operating system.

D. The manuals shall be provided in three-ring side binders with durable plastic covers.

E. The manuals shall contain a detailed table of contents and have tab dividers for major sections and special equipment.

F. The Owner will not accept any training or equipment unless the maintenance manuals are received a minimum of 10 working days prior to request for Training/Turnover.
1.13 START-UP EQUIPMENT AND SYSTEMS

A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.

B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

1.14 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Architect to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorizes representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.

1.15 AS-BUILT DRAWINGS

A. The Contractor shall, during the progress of the job, keep a set of record prints on which he shall mark all changes. After completion of a CADD release form by the Contractor and near the conclusion of the job, the Architect will provide the Contractor with one set of AutoCAD electronic files of the Mechanical, Plumbing, and Electrical Drawings. The Contractor shall draft on these electronic files all changes made during the progress of the work and return them and one set of paper plans with the changes to the Architect as "As-Built Drawings".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Each item of equipment furnished on this project shall have local representation, factory-authorized service and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 50 miles of the project site."

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS
A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

2.5 DIELECTRIC FITTINGS
A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 MECHANICAL SLEEVE SEALS
A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel or stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES
A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
C. Cast Iron: Cast or fabricated “wall pipe” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 ESCUTCHEONS
A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.
D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.
E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT
A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   2. Design Mix: 5000-psi, 28-day compressive strength.

2.10 FLAME SPREAD PROPERTIES OF MATERIALS
A. Materials used for insulation, acoustical linings, adhesives, jackets and coatings, and combinations of these materials, shall each have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less, as determined by an independent testing laboratory in accordance with NFPA-255.
2.11 FIRESTOPPING

A. Provide firestopping in sealing of penetrations in fire-rated construction, horizontal and vertical, including the following materials:
   1. Foam: Dow Corning Firestop silicone RTV foam, liquid component Part A (black) and liquid component Part B (off-white).
   2. Sealant: 3M 1000NS and 1003SL silicone adhesive sealant, single component, neutral cure, and non-slumping.
   3. Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, and plywood or particle board, as selected by the applicator.

B. Mixes shall conform to the manufacturer's directions.

2.12 ACCESS PANELS AND DOORS

A. Provide wall and ceiling access doors for unrestricted access to concealed valves, dampers, and other mechanical equipment items and devices.

B. Access doors mounted in surfaces to be painted shall be Milcor Style "K" for plastered surfaces, and Style "M" for non-plastered surfaces. Style "K" doors shall be set with door flush with adjacent surfaces. Access doors mounted on tile surfaces shall be stainless steel and of similar styles as the carbon steel access doors described above. Access doors shall be not less than 12" x 12" in size.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping in its entirety. If a portion of piping is to remain active, plug remaining piping with same or compatible piping material.
   2. Ducts to Be Removed: Remove portion of duct in its entirety. If a portion of duct is to remain active, cap and seal with same or compatible ductwork material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment including housekeeping pad.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. 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.

E. Disruptions: Maintain existing plumbing, heating, ventilating, air conditioning, fire protection, and other existing systems, and maintain all existing functions in service except for scheduled 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.

F. Scheduling of Disruption: Seek and obtain approval two weeks in advance of event for date, starting, and duration of each required disruption.

G. Notice of Disruption: Date, time and duration of each disruption shall be subject to the Owner's prior approval, and shall include the following information in the form of a memorandum submitted by the Contractor to the Architect for approval by the Owner:

   Facility/System Date Starting Time/Duration
H. 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.

I. Notification: Notify the Architect and the owner immediately, by telephone and then in writing, as changes and additions to the scheduled disruption requirements become known.

J. Duration: Complete as large a portion of the work as possible before initiating disruption and perform only that work necessary so as to minimize duration of disruption. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal service.

K. General:
1. Modify remove, or relocate materials and items indicated on the Drawings or required by the installation of new facilities.
2. Remove demolition materials from the site and deliver salvage materials to destinations on the premises, as directed.

L. 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 reserve 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 and to restore to good operating order.
5. Perform the relocation work in accordance with applicable Sections of the Specifications, utilizing skilled workers.

M. Relocating Devices: Remove and reinstall in locations designated by the Architect temperature control system devices, relays, piping, ductwork, equipment and other devices required for the operation of the various systems that are installed in existing-to-be-renovated construction.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.
K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, rated gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONSTRUCTION REQUIREMENTS

A. The Drawings and Specifications are intended to accomplish certain objectives. They show pipe and duct sizes, general routing and location, and describe the various systems. These documents describe and size equipment, its general location, usage, support and auxiliary requirements. They describe most, but not all of the materials and their usage for this project.

B. Contract Documents do not, however, detail certain job requirements. They do not show exact layouts, locations or elevations of ducts, expansion joints, anchors, sleeves, hangers, slots, holes, outlets, inserts, elbows, fittings, thermometers, thermostats, gauges, wells, underfloor drains, sumps, or access doors. They do not show final precise locations of equipment by dimensions in most instances, or manufacturer’s requirements for proper installation, operation and maintenance.

C. The exact location of each item shall be determined by reference to the project Contract Drawings, and to details, equipment drawings, and roughing-in drawings, by measurements at the building, and in cooperation with the various trades. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

D. Coordinate proper locations and sizes of slots, holes or openings in the building structure pertaining to this work, and for the correct location of sleeves. Place inserts to accommodate the ultimate installation of hangers in the forms, and set sleeves in forms before concrete is poured, and in masonry walls while they are under construction. Concealed lines shall be installed as required by the pace of the job to precede the general construction.

E. Study construction documents and lay out piping work carefully in advance of fabrication and erection, in order to meet the requirements of the extremely limited spaces. Where conflicts occur, work with all involved trades and resolve the conflict prior to erection of any work in the area involved.
3.7 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer’s written instructions and according to seismic codes at Project.
   1. Construct minimum 3-1/2” concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Provide No. 3 bars at 2'-0” o.c. each way.
   2. Install No. 3 dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer’s setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer’s written instructions.
   7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."
   8. Chamfer corners of all housekeeping pads.
   9. Provide necessary foundations for exterior equipment pads and confirm construction of required pads with structural engineer.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.11 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.
E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.12 EXCAVATION AND BACKFILL FOR MECHANICAL WORK

A. Excavation
   1. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that
time lapse from excavation to completion of backfilling will be minimum.
   2. Excavate with vertical sided excavations to greatest extent possible, except where otherwise
indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations.
Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger
work or other property. Where not removed, cut sheeting off at sufficient distance below finished
grade to not interfere with other work.
   3. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise
shown or required for proper installation of pipe joists, fittings, valves and other work. Excavate for
other mechanical work to provide minimum practical but adequate working clearances.
   4. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate
beyond indicated depths, and hand-excavate bottom cut to accurate elevations.
   5. Depth for Subbase Support: For large piping (6" pipe size and larger), tanks, and where indicated
for other mechanical work, excavate for installation of subbase material in depth indicated or, if not
otherwise indicated, 6" below bottom of work to be supported.
   6. Shoring and Bracing: Provide materials for shoring and bracing to comply with local codes and
authorities having jurisdiction. Maintain shoring and bracing in excavations regardless of time
period excavations will be open. Carry down shoring and bracing as excavation progresses.
   7. Excavation for Trenches:
      a. Dig trenches to uniform width required for particular item to be installed, sufficiently wide to
provide ample working room. Provide 6" to 9" clearance on both sides of piping.
      b. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to
establish indicated flow lines and invert elevations. Beyond building perimeter, keep
bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
      c. Where rock is encountered, carry excavation 6" below required elevation and backfill with 6"
layer of crushed stone or gravel prior to installation of pipe.
      d. For piping 5" or less in nominal size, do not excavate beyond indicated depths. Hand
excavate bottom cut to accurate elevations and support piping on undisturbed soil.
      e. For piping 6" and larger in nominal size, tanks, and other mechanical work indicated to
receive subbase, excavate to subbase depth indicated, or if not otherwise indicated, to
below bottom of work to be supported.
      f. Grade bottoms of trenches as indicated, notching under piping couplings to provide solid
bearing for entire body of piping.
      g. Depth for Exterior Piping: Except as otherwise indicated, excavate for exterior piping so that
depth of cover shall be 18" minimum.
      h. Excavate near large trees (within drip line) by hand, and protect root system from damage
or dryout to greatest extent possible. Maintain moist condition for root system and cover
exposed roots with burlap. Paint root cuts of 1" diameter and larger with asphaltic tree
paint.
      i. Store excavated material (temporarily) near excavation, in manner that will not interfere with
or damage excavation or other work. Do not store under trees (within drip line). Retain
excavated material that complies with requirements for backfill material. Dispose of
excavated material that is either in excess of quantity needed for backfilling or does not
comply with requirements for backfill material.

B. Backfill
   1. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is
indicated.
   2. Backfill with finely-graded subbase material to 6" above wrapped, coated, and plastic piping and
tanks, and to centerline of other tanks.
3. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

4. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously; do not dislocate work from installed positions.

5. Backfill excavations in 8” high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.

6. Lawn and Landscaped Areas: 85% for cohesive soils; 90% for cohesionless soils.

7. Paved Areas Other Than Roadways: 90% for cohesive soils; 95% for cohesionless soils.

8. Roadways: 90% for cohesive soils; 95% for cohesionless soils.

9. Backfill to elevations matching adjacent grades, at a time of backfilling excavations for mechanical work.

C. Performance and Maintenance

1. Subsidence: Where subsidence is measurable or observable at mechanical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION
SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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.

B. Refer to Common Motor Requirements for Equipment, Section 220513, for HVAC motors.

PART 2 - PRODUCTS (Not Used.)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
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SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

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. Flexible, ball-joint, packed expansion joints.
   2. Slip-joint packed expansion joints.
   3. Expansion-compensator packless expansion joints.
   5. Metal-bellows packless expansion joints.
   6. Rubber packless expansion joints.
   8. Pipe loops and swing connections.
   9. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
   2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
   3. Alignment Guide Details: Detail field assembly and attachment to building structure.
   4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKED EXPANSION JOINTS

A. Flexible, Ball-Joint, Packed Expansion Joints:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advanced Thermal Systems, Inc.
4. Design: For 360-degree rotation and angular deflection.
5. Minimum Pressure Rating: 250 psig at 400 deg F.
6. Angular Deflection for NPS 6 and Smaller: 30 degree minimum.
7. Angular Deflection for NPS 8 and Larger: 15 degree minimum.
8. End Connections for NPS 2 and Smaller: Threaded.

B. Slip-Joint Packed Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advanced Thermal Systems, Inc.
   b. Hyspan Precision Products, Inc.
4. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
5. Configuration: Single joint and/or double joint as indicated on the drawings.
6. End Connections: Flanged or weld ends to match piping system.

2.2 PACKLESS EXPANSION JOINTS

A. Metal, Expansion-Compensator Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Flexicraft Industries.
   b. Hyspan Precision Products, Inc.
   c. Metraflex, Inc.
2. Minimum Pressure Rating: 150 psig unless otherwise indicated.
3. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.
   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.
4. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.
   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged.

B. Rubber, Expansion-Compensator Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
   b. Flexicraft Industries.
3. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
4. End Connections for NPS 2 and Smaller: Threaded.

C. Flexible-Hose Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Flexicraft Industries.
   b. Metraflex, Inc.
2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.
a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

D. Metal-Bellows Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Flexicraft Industries.
   b. Flo Fab Inc.
   c. Hyspan Precision Products, Inc.
   d. Metraflex, Inc.
   e. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.


3. Type: Circular, corrugated bellows with external tie rods.


5. Configuration: Single joint and/or double joint as indicated on the drawings.

   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: threaded.
   c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.

   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

E. Rubber Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
   b. Flexicraft Industries.
4. Arch Type: Multiple arches.
5. Spherical Type: Multiple spheres.
6. Minimum Pressure Rating for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
7. Minimum Pressure Rating for NPS 5 and NPS 6: 140 psig at 200 deg F.
8. Minimum Pressure Rating for NPS 8 to NPS 12: 140 psig at 180 deg F.
9. Material for Water: EPDM.

2.3 GROOVED-JOINT EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Anvil International, Inc.
2. Victaulic Company.
B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
C. Standard: AWWA C606, for grooved joints.
D. Nipples: ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.
E. Couplings: Flexible type for steel-pipe dimensions. Include ferrous housing sections, EPDM gasket suitable for cold and hot water, and bolts and nuts.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:
1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.
B. Anchor Materials:
1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.
B. Install packed-type expansion joints with packing suitable for fluid service.
C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

D. Install rubber packless expansion joints according to FSA-NMEJ-702.

E. Install grooved-joint expansion joints to grooved-end steel piping

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:
   2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
   1. Anchor Attachment to Steel Structural Members: Attach by welding.
   2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION
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SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

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. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Test plugs.
5. Sight flow indicators.

B. Related Sections:
1. Division 23 Section "Facility Natural-Gas Piping" for gas meters.
2. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Stem: Aluminum and of length to suit installation.
   b. Design for Thermowell Installation: Bare stem.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

A. Thermowells:
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
2. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
9. Ring: Metal.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.5 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: EPDM self-sealing rubber.

2.6 SIGHT FLOW INDICATORS

A. Description: Piping inline-installation device for visual verification of flow.

B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

C. Minimum Pressure Rating: 150 psig.

D. Minimum Temperature Rating: 200 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install test plugs in piping tees.

I. Install flow indicators in piping systems in accessible positions for easy viewing.

J. Install permanent indicators on walls or brackets in accessible and readable positions.

K. Install connection fittings in accessible locations for attachment to portable indicators.

L. Install thermometers in the following locations:
   1. Inlet and outlet of each hydronic zone.
   2. Inlet and outlet of each hydronic boiler.
   3. Two inlets and two outlets of each chiller.
   4. Inlet and outlet of each hydronic coil in air-handling units.
   5. Two inlets and two outlets of each hydronic heat exchanger.
   6. Inlet and outlet of each thermal-storage tank.
   7. Outside-, return-, supply-, and mixed-air ducts at AHUs.
   8. Outlet of each domestic water heater or storage tank.

M. Install pressure gages in the following locations:
   1. Discharge of each pressure-reducing valve.
   2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
   3. Suction and discharge of each pump.
   4. Inlet and outlet of each hydronic coil in air handling units.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

B. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F.

C. Scale Range for Air Ducts: Minus 40 to plus 110 deg F.

D. Scale Range for Domestic Hot Water: 30 to 180 deg. F with 2-degree divisions (minus 1 to plus 82 deg. C, with 1-degree divisions).
3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION
SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

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.

B. Refer to General Duty Valves for piping systems, Section 220523, for HVAC valves.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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.

B. Refer to Hangers and Supports for Piping and Equipment, Section 220529, for HVAC supports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 230548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

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. This Section includes the following:
   1. Isolation pads.
   2. Freestanding and restrained spring isolators.
   3. Elastomeric hangers.
   4. Spring hangers.
   5. Restrained vibration isolation roof-curb rails.
   6. Steel and inertia, vibration isolation equipment bases.

1.3 DEFINITIONS

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation to select vibration isolators, and for designing vibration isolation bases.
   2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
   3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
   4. Select the required minimum isolator deflection to satisfy the requirements of each piece of equipment at each unique installation.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed in the specification.
   1. Amber/Booth Company, Inc.
   3. Mason Industries.
   4. Vibration Eliminator Co., Inc.

B. Pads (Type 1): Arranged in two 3/8” layers of sufficient stiffness for uniform loading over pad area, molded with a non-slip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
   1. Resilient Material: Oil- and water-resistant neoprene.
   2. Peabody Type NGDD, Mason Type WSW or approved equal.

C. Elastomeric Hangers (Type 2a): A rubber suspension type isolator with an elastomeric hanger, consisting of a rectangular steel box and elastomeric isolation element, which shall be of Neoprene or high quality synthetic rubber with ozone and anti-oxidant additives. The elements shall be designed for approximately 1/4-inch deflection and loaded so that deflection does not exceed 15% of the free height of the element. The design shall prevent metal-to-metal contact between the hanger rod and the steel box. Shall be Peabody Type RH, Mason Type HD, or approved equal.

D. Spring Isolators (Type 3): Provide a base mount type isolator with adjustable, free standing open-spring mounting with combination leveling bolt and equipment fastening bolt. The spring (or springs) shall be rigidly attached to the mounting baseplate and to the spring compression plate. To assure stability, the outside diameter shall be a minimum of 0.8 times the vertical operating height. The isolator shall be designed for a minimum Kx/Ky (horizontal to vertical spring rate) of 1.0. A Neoprene pad having a minimum thickness of 1/4-inch shall be bonded to the bottom of the baseplate. Baseplates shall be sized to limit pad loading to 100psi. Shall be Peabody type FDS, Mason Type SLF, or approved equal.

E. Spring Hangers (Type 3a): A suspension type isolator with spring hanger consisting of a rectangular steel box, coil springs, spring cups, Neoprene impregnated fabric washer, steel washer and Neoprene insert designed to prevent metal-to-metal contact between the rod and the bottom of the hanger box. The hanger box shall be capable of supporting 40% of rated load without noticeable deformation of failure. Shall be Peabody type SH, Mason Type HS, or approved equal.

F. Spring Hangers (Type 3b): A suspension type isolator with spring hanger as described in Type 3a, with the addition of an elastomeric element at the top of the box for acoustic isolation. The design shall prevent metal-to-metal contact between the hanger rod and the top of the hanger box. The elastomeric element shall meet the design requirements for Type 2 mounting. Shall be Peabody Type SRH, Mason Type DNHS, or approved equal.

G. Restrained Spring Isolators (Type 4): A base mount type isolator with an adjustable, open-spring isolator having one or more coil springs rigidly attached to a top compression plate and a baseplate. A ribbed or waffled neoprene pad having a minimum thickness of 1/4-inch shall be bonded to the bottom of the baseplate. The isolator shall fit within a welded steel enclosure consisting of a top plate and a rigid lower housing, serving as a blocking device during installation. Restraining bolts shall connect the top-plate and lower housing to prevent the isolated equipment from rising when drained of water. Neoprene grommets shall be provided to prevent metal-to-metal contact between the restraining bolts and isolator housing. Baseplates shall be sized to limit pad loading to 100 psi, and springs shall be designed for a minimum Kx/Ky (horizontal to vertical spring rate) of 1.0. Shall be Peabody type FLS, Mason Type SLR, or approved equal.

H. Riser Isolators: Provide manufacturer’s standard pad-type isolator bonded to steel plate, formed for welding to pipe sleeve extension.

I. Riser Support Isolators: Provide manufacturer’s standard pad-type isolator laminated between two formed steel plate members, one for welding to pipe sleeve extension and the other for welding to pipe riser.
2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS (Type D)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
2. Mason Industries.
3. Vibration Eliminator Co., Inc.

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment.

C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators.
   a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
   b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. No Base (Type A): Isolators directly attached to equipment.

B. Structural Steel Rails or Base (Type B): Where rails or beams are indicated for use with isolator units to support equipment, provide structural steel support members with isolator support brackets and anchor bolt holes, designed by the vibration isolation materials manufacturer. Structural steel bases shall comply with ANSI/ASTM A36, and shall have a minimum depth equal to 10% of the longest span between isolators, but not less than (4) inches, or as indicated in the Drawings. Sizes and shapes shall be as requires for equipment to be supported. Isolator support brackets shall be welded to the structural beam base as required to provide the lowest possible mounting height of supported equipment. Steel beams shall provide a rigid, distortion-free mounting base for supported equipment without excessive differential motion between driving and driven equipment components.

C. Inertia Base (Type C): Provide reinforced concrete inertia blocks, including perimeter steel pouring form, reinforcing bars, welded in place, bolting templates, and height saving brackets for mounting of the isolators. Each inertia block shall have a thickness of at least six (6) inches, or greater, as required to provide a rigid mounting for equipment. The weight of each inertia block shall not be less than 150% of the weight of equipment supported. Inertia blocks shall be sized to extend not less than four (4) inches beyond the base of the supported equipment in each direction and shall be T-shaped where necessary to conserve space. Inertia blocks for pumps shall support the suction elbows on end suction pumps, and
both the suction and discharge elbows on horizontal split case pumps. Perimeter steel members shall be structural channels having a minimum depth of 10% of the longest span, but not less than six (6) inches. Shall be Peabody Type C1B-H, Mason Type KSL or BMK, or approved equal.

2.4 FACTORY FINISHES

   A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

   B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel or powder coat for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

   B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

   A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

   B. This work in general shall include, but not necessarily be limited to, the following:
   1. Isolate all mechanical and electrical equipment from the building structure by means of appropriately selected noise and vibration isolator.
   2. Piping over 1-inch o.d. located in mechanical equipment rooms, for minimum of 50 feet or 100 pipe diameters (whichever is greater) from the connection to the vibration isolated equipment, shall be isolated from the building structure by means of noise and vibration isolation hangers. Provide the first three (3) hangers or support points in each direction from each piece of isolated equipment, with vibration isolation hangers or supports having the same static deflection as the equipment isolators.
   3. Ductwork which is rigidly attached to isolated air moving equipment in mechanical equipment rooms shall be isolated from the building structure by means of noise and vibration isolation hangers or mounts for a minimum of 50 feet.
   4. Isolate piping and duct vertical risers from the building structure by means of noise and vibration isolation guides and supports.

   C. Piping and ductwork isolated in accordance with these Specifications shall freely pass through walls and floors without rigid connections. After installation of piping and ductwork, caulk penetrations airtight.

   D. General: Comply with the minimum static deflections recommended by the ASHRAE, including definitions of critical and non-critical locations, for selection and application of vibration isolation materials and units as indicated.

   E. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.
3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section “Roof Accessories” for installation of roof curbs, equipment supports, and roof penetrations.

B. Piping Restraints:
   1. Comply with requirements in MSS SP-127.

C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer’s recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.5 HVAC VIBRATION-CONTROL DEVICE SCHEDULE

A. Below is a schedule of isolated equipment for this project. Any equipment, system, construction or condition that may be altered, added or changed, or that is not specifically considered herein or on the drawings, shall be treated in the same manner as specified for similar equipment, systems, or construction shall comply with the noise and vibration isolation requirements of these specifications.

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>BASE TYPE</th>
<th>ISOLATOR TYPE</th>
<th>ISOLATOR DEFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FANS</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cabinet, floor-mounted</td>
<td>A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Cabinet, suspended</td>
<td>-</td>
<td>3b</td>
<td></td>
</tr>
<tr>
<td>Centrifugal, DWDI, floor-mounted</td>
<td>C</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Axial flow, floor-mounted</td>
<td>C</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Centrifugal, in-line floor-mounted</td>
<td>C</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

PURDY-MCGUIRE, INC. 230548 - 5
VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT
<table>
<thead>
<tr>
<th>Component</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrifugal, in-line, suspended</td>
<td>-</td>
<td>3b&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Utility vent sets</td>
<td>A or B</td>
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<tr>
<td>Roof exhausters, curb-mounted</td>
<td>A&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Cooling Towers, roof mounted</td>
<td>B</td>
<td>3 or 4&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>PIPING</td>
<td>A</td>
<td>2a, 3a or 3b</td>
</tr>
<tr>
<td>DUCTS</td>
<td>A</td>
<td>2a, 3a or 3b</td>
</tr>
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<td><strong>AIR HANDLING UNITS</strong></td>
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<td></td>
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<tr>
<td>Factory-fabricated, floor-mounted</td>
<td>A</td>
<td>3&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Factory-fabricated, suspended</td>
<td>-</td>
<td>3b&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Factory-fabricated, roof-mounted</td>
<td>D&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>Factory-fabricated, roof-mounted</td>
<td>A or B</td>
<td>3</td>
</tr>
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<td><strong>CHILLERS</strong></td>
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<td>Grade Supported</td>
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<td><strong>PUMPS</strong></td>
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<td>Floor Mounted</td>
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<tr>
<td>Suspended</td>
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<tr>
<td>Packaged Systems</td>
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<tr>
<td><strong>AIR COMPRESSORS</strong></td>
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<td>Reciprocating</td>
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<td>4</td>
</tr>
<tr>
<td>Rotary or centrifugal</td>
<td>C</td>
<td>4</td>
</tr>
</tbody>
</table>

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a. Mount isolation between curb and fan.
b. Mount units on steel channel frame and suspend frame from structure.
c. Cooling tower supports shall be selected and employed in a manner that results in supporting the cooling tower in conformance with the recommendations of the tower manufacturer.
d. Custom fabricated curb fit to the dimensions and weights of the RTU.
e. Delete isolators beneath unit if internally isolated. In lieu of spring isolators, provide isolation type 1.

### 3.6 TESTING AND CERTIFICATION

A. Upon completion of the installation and after the system is put into operation, inspect the systems of vibration control and correct any discrepancies or make adjustments. If necessary, instrumentation tests and measurements shall be made to determine the source, cause, and path of any objectionable vibration. After such tests are completed, take proper steps to correct the objectionable condition.

B. The noise and vibration control equipment manufacturer or his designated representative shall certify the correctness of the installation and compliance with requirements of this Section.

**END OF SECTION**
SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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.

B. Refer to Identification for Piping and Equipment, Section 220553, for HVAC identification.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:
      a. Constant-volume air systems.
      b. Variable-air-volume systems.
   2. Balancing Hydronic Piping Systems:
      a. Constant-flow hydronic systems.
      b. Variable-flow hydronic systems.

B. Related Sections
   1. Division 23 Section “Metal Ducts” for duct sealing and testing.

1.3 DEFINITIONS

C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. LEED Submittal:

B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage an impartial TAB entity certified by AABC.
   1. The firm will be one that is organized to provide independent professional testing, adjusting and balancing services. The firm shall have one (1) Professional Engineer licensed in the state where the project is located, with current registration.
   2. The firm will have operated a minimum of five (5) years under its current firm name.
   3. All personnel used on the jobsite shall be either TAB engineers or TAB technicians who shall have been permanent, full-time employees of the firm for a minimum of six (6) months prior to working on this specific project.
   4. 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 Professional Engineer and all personnel to be assigned to this project.
      b. Proof of company operation for a minimum of five (5) years.
B. TAB Conference: Meet with Architect-Engineer and Commissioning Authority for approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days’ advance notice of scheduled meeting time and location.

1. Agenda Items:
   b. The TAB plan.
   c. Coordination and cooperation of trades and subcontractors.
   d. Coordination of documentation and communication flow.

1.6 COORDINATION

A. Notice: Provide seven (7) days advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests after air and water distribution systems have been satisfactorily completed.

C. The contractor shall make any changes in the sheaves, belts, motors, dampers and valves or the addition of dampers and/or valves as required, to correctly balance the HVAC systems, at no additional cost.

D. The automatic temperature control contractor and/or energy management system contractor 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 contractor and/or energy management system contractor shall provide technical support (technicians and necessary computers) to the TAB agency for a complete check of these systems. The scope of the TAB work as defined herein is indicated in order that the contractor will be apprised of his 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/or owner for the satisfactory execution of the TAB services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems’ output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design.” Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine system pumps to ensure absence of entrained air in the suction piping.

M. Examine operating safety interlocks and controls on HVAC equipment.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Hydronic systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Equipment and duct access doors are securely closed.
   5. Balance, smoke, and fire dampers are open.
   6. Isolating and balancing valves are open and control valves are operational.
   7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
   1. Comply with requirements in ASHRAE 62.1, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts or install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare schematic diagrams of systems’ “as-built” duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section “Metal Ducts.”

M. 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.

N. 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. The ATC contractor shall assist the TAB firm as required.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Report the cleanliness status of filters and the time static pressures are measured.
   4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
   5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.
C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check liquid level in expansion tank.
   3. Check makeup water-station pressure gage for adequate pressure for highest vent.
   4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
   5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
   6. Set system controls so automatic valves are wide open to heat exchangers.
   7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
   8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
   1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
      a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Commissioning Authority and comply with requirements in Division 23 Section "Hydronic Pumps."
   2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
      a. Monitor motor performance during procedures and do not operate motors in overload conditions.
   3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
   4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
J. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.11 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
   1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
   2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
   3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
   4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
   5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
   7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.12 PROCEDURES FOR COOLING TOWERS

A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
   1. Measure condenser-water flow to each cell of the cooling tower.
   2. Measure entering- and leaving-water temperatures.
   3. Measure wet- and dry-bulb temperatures of entering air.
   4. Measure wet- and dry-bulb temperatures of leaving air.
   5. Measure condenser-water flow rate recirculating through the cooling tower.
   6. Measure cooling-tower spray pump discharge pressure.
   7. Adjust water level and feed rate of makeup water system.
   8. Measure flow through bypass.

3.13 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.
C. Record compressor data.

3.14 PROCEDURES FOR BOILERS
A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.
B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

3.15 PROCEDURES FOR HEAT-TRANSFER COILS
A. Measure, adjust, and record the following data for each coil:
   1. Entering- and leaving-water temperature.
   2. Water flow rate.
   3. Water pressure drop.
   4. Dry-bulb temperature of entering and leaving air.
   5. Wet-bulb temperature of entering and leaving air for cooling coils.
   6. Airflow.
   7. Air pressure drop.

3.16 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS
A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
   1. Measure and record the operating speed, airflow, and static pressure of each fan.
   2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
   3. Check the refrigerant charge.
   4. Check the condition of filters.
   5. Check the condition of coils.
   6. Check the operation of the drain pan and condensate-drain trap.
   7. Check bearings and other lubricated parts for proper lubrication.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
   1. New filters are installed.
   2. Coils are clean and fins combed.
   3. Drain pans are clean.
   4. Fans are clean.
   5. Bearings and other parts are properly lubricated.
   6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
   1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
   2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
   3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
   4. Balance each air outlet.

3.17 TOLERANCES
A. Set HVAC system’s air flow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 or minus 5 percent.
   2. Air Outlets and Inlets: Plus 10 or minus 5 percent.
   3. Heating-Water Flow Rate: Plus 10 or minus 5 percent.
   4. Cooling-Water Flow Rate: Plus 10 or minus 5 percent.
3.18 **FINAL REPORT**

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans and pump performance forms including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume systems.
      g. Settings for supply-air, static-pressure controller.
      h. Other system operating conditions that affect performance.

D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Unit arrangement and class.
      g. Discharge arrangement.
      h. Sheave make, size in inches, and bore.
      i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
      j. Number, make, and size of belts.
      k. Number, type, and size of filters.
   2. Motor Data:
      a. Motor make, and frame type and size.
      b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
   a. Total air flow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat-coil static-pressure differential in inches wg.
   g. Cooling-coil static-pressure differential in inches wg.
   h. Heating-coil static-pressure differential in inches wg.
   i. Outdoor airflow in cfm.
   j. Return airflow in cfm.
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

E. Apparatus-Coil Test Reports:
   1. Coil Data:
      a. System identification.
      b. Location.
      c. Coil type.
      d. Number of rows.
      e. Fin spacing in fins per inch o.c.
      f. Make and model number.
      g. Face area in sq. ft.
      h. Tube size in NPS.
      i. Tube and fin materials.
      j. Circuiting arrangement.
   2. Test Data (Indicated and Actual Values):
      a. Air flow rate in cfm.
      b. Average face velocity in fpm.
      c. Air pressure drop in inches wg.
      d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
      e. Return-air, wet- and dry-bulb temperatures in deg F.
      f. Entering-air, wet- and dry-bulb temperatures in deg F.
      g. Leaving-air, wet- and dry-bulb temperatures in deg F.
      h. Water flow rate in gpm.
      i. Water pressure differential in feet of head or psig.
      j. Entering-water temperature in deg F.
      k. Leaving-water temperature in deg F.
      l. Refrigerant expansion valve and refrigerant types.
      m. Refrigerant suction pressure in psig.
      n. Refrigerant suction temperature in deg F.
      o. Inlet steam pressure in psig.

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
   1. Unit Data:
      a. System identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Fuel type in input data.
      g. Output capacity in Btu/h.
      h. Ignition type.
      i. Burner-control types.
      j. Motor horsepower and rpm.
      k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):
   a. Total air flow rate in cfm.
   b. Entering-air temperature in deg F.
   c. Leaving-air temperature in deg F.
   d. Air temperature differential in deg F.
   e. Entering-air static pressure in inches wg.
   f. Leaving-air static pressure in inches wg.
   g. Air static-pressure differential in inches wg.
   h. Low-fire fuel input in Btu/h.
   i. High-fire fuel input in Btu/h.
   j. Manifold pressure in psig.
   k. High-temperature-limit setting in deg F.
   l. Operating set point in Btu/h.
   m. Motor voltage at each connection.
   n. Motor amperage for each phase.
   o. Heating value of fuel in Btu/h.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
   1. Unit Data:
      a. System identification.
      b. Location.
      c. Coil identification.
      d. Capacity in Btu/h.
      e. Number of stages.
      f. Connected volts, phase, and hertz.
      g. Rated amperage.
      h. Air flow rate in cfm.
      i. Face area in sq. ft.
      j. Minimum face velocity in fpm.
   2. Test Data (Indicated and Actual Values):
      a. Heat output in Btu/h.
      b. Air flow rate in cfm.
      c. Air velocity in fpm.
      d. Entering-air temperature in deg F.
      e. Leaving-air temperature in deg F.
      f. Voltage at each connection.
      g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   1. Fan Data:
      a. System identification.
      b. Location.
      c. Make and type.
      d. Model number and size.
      e. Manufacturer's serial number.
      f. Arrangement and class.
      g. Sheave make, size in inches, and bore.
      h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   2. Motor Data:
      a. Motor make, and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
      g. Number, make, and size of belts.
   3. Test Data (Indicated and Actual Values):
      a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft.
   g. Indicated air flow rate in cfm.
   h. Indicated velocity in fpm.
   i. Actual air flow rate in cfm.
   j. Actual average velocity in fpm.
   k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:
1. Unit Data:
   a. System and air-handling unit identification.
   b. Location and zone.
   c. Apparatus used for test.
   d. Area served.
   e. Make.
   f. Number from system diagram.
   g. Type and model number.
   h. Size.
   i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm.
   b. Air velocity in fpm.
   c. Preliminary air flow rate as needed in cfm.
   d. Preliminary velocity as needed in fpm.
   e. Final air flow rate in cfm.
   f. Final velocity in fpm.
   g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.
   d. Water pressure drop in feet of head or psig.
   e. Entering-air temperature in deg F.
   f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):
   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.
   h. Final total pressure in feet of head or psig.
   i. Final water flow rate in gpm.
   j. Voltage at each connection.
   k. Amperage for each phase.

M. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.19 INSPECTIONS

A. Initial Inspection:
   1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
   2. Check the following for each system:
      a. Measure airflow of at least 5 percent of air outlets.
      b. Measure water flow of at least 5 percent of terminals.
      c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
      d. Verify that balancing devices are marked with final balance position.
      e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
   1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
   2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
   3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to 5 percent of the total measurements recorded.
   4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
   1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.20 ADDITIONAL TESTS

A. Thoroughly test the Energy Management System (EMS). 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 contractor and/or EMS contractor shall provide technical support to the TAB Firm for a complete check of the HVAC temperature controls and/or the Energy Management System.

B. After testing, adjusting and balancing to 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.

C. Make a total of 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 to be coordinated with Architect/Engineer and Owner and shall be documented with a supplemental report containing data and information as required.

D. 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 adjustment 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.

END OF SECTION
SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Insulation Schedule Shown on Plans

1.2 SUMMARY

A. Section Includes:
   1. Insulation Materials
   2. Fire-rated insulation systems.
   3. Factory-applied jackets.
   4. Field-applied jackets.
   5. Securements.

B. Related Sections:
   1. Section 220700 - Plumbing Insulation.
   2. Section 233113 - Metal Ducts for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Compliant Adhesives and Sealants:
   1. Product Data for Credit IEQ-Low-Emitting Materials: For adhesives and sealants, including printed statement of VOC content.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All insulation shall be kept dry and clean during storage and installation. Insulation that becomes wet shall be discarded.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
C. Coordinate installation and testing of heat tracing.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Johns Manville; Thermo-12 Gold.
      b. Or, approved equal.
   2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Elastomeric Closed Cell Foam: Comply with ASTM C 534, (0.28 Btu in/hr ft² at 75 degrees F), and containing anti-microbial product protection. Temperature range of -220 deg F to +220 deg F.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armacell LLC; AP Armaflex.
      b. Or, approved equal.

H. Glass Fiber Duct Wrap: Rigid, resin bonded fibrous glass blanket with a damage resistant, flame retardant, reinforced aluminum foil facing (FRK). Comply with ASTM C1136, Type II and ASTM C1290 Type III requirements. Type 75 (0.75 lb/cu.ft density). Thermal Conductivity shall be 0.30 Btu*in/h*ft² at 75 degrees F.) R value for 1.5" = 4.2, 2.0"=5.6, 2.2"=6.0 installed.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.;
      b. Johns Manville;
      c. Knauf Insulation;
      d. Owens Corning;

I. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB (0.24 Btu in/h ft² at 75 degrees F). For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.
      b. Johns Manville;
      c. Knauf Insulation;
      d. Owens Corning;

J. Glass Fiber Pipe and Tank Insulation: Molded fibrous glass pipe insulation with factory-applied ASJ complying with ASTM C1393 and ASTM E96. Nominal density is 3.5 lb/cu. ft. or more. Thermal
conductivity (k-value) at 100 deg F is 0.24 Btu x in./h x sq. ft. x deg F or less. Operating range of 0 deg F to 1,000 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.

K. VaporWick Pipe Insulation: Molded fibrous glass pipe insulation with self-drying type with vapor retarder with factory-applied integral vapor retarder. Provide factory jacket complying with ASTM C1393 and ASTM D774. Thermal conductivity (k-value) at 100 deg F is 0.24 Btu x in./h x sq. ft. x deg F or less. Operating range of 32 deg F to 220 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; FlameChek.
   b. Johns Manville; Firetemp Wrap.
   c. Thermal Ceramics; FireMaster Duct Wrap.
   d. FyreWrap.

2.3 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136.

2.4 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Zeston.
   c. Proto PVC Corporation; LoSmoke.

2. Color: White
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
4. Factory-fabricated tank heads and tank side panels.
5. 25 Flame Spread, 50 Smoke Developed.

C. Metal Jacket:
   a. 0.016” up through 24” pipe size, 0.024” for pipe sizes larger than 24” and all ductwork.
2. Stainless Steel Jacket: Type T-304.
   a. 0.010” smooth finish
   b. 0.010” corrugated finish for diameters larger than 6 feet.
3. 
D. Self-Adhesive Outdoor Jacket: 60-mil thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with stucco-embossed aluminum-foil facing.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Polyguard; Alumaguard 60.

2.5 SECUREMENTS

A. Bands:
   1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide.
   2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:
   1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
   2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
      a. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   5. Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations.Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistant joint sealers.
   2. Provide UL-approved assemblies.

F. Insulation Installation at Floor Penetrations:
   1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Pipe: Install insulation continuously through floor penetrations.
   3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
   1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
   2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
   a. Do not weld anchor pins to ASME-labeled pressure vessels.
   b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
   c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
   d. Do not overcompress insulation during installation.
   e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
   f. Impale insulation over anchor pins and attach speed washers.
   g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CALCIUM SILICATE INSULATION INSTALLATION

A. Insulation Installation on Boiler Breechings and Ducts:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation material.

2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

3. On exposed applications without metal jacket, finish insulation surface with a skim coat of mineral-fiber, hydraulic-setting cement. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth. Thin finish coat to achieve smooth, uniform finish.
B. Insulation Installation on Straight Pipes and Tubes:
   1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
   2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
   3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

C. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
   4. Finish flange insulation same as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer’s written instructions.
   2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
   3. Finish fittings insulation same as pipe insulation.

E. Insulation Installation on Valves and Pipe Specialties:
   1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   2. Install insulation to flanges as specified for flange insulation application.
   3. Finish valve and specialty insulation same as pipe insulation.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
E. Insulation Installation on Ductwork:
   1. Install sheet insulation as duct liner where indicated on the drawings or elsewhere in the specifications.
   2. Adhesive should have 100% coverage applied to both surfaces.
   3. Install according to ASTM C1710 and manufacturer’s recommendations.

3.9 GLASS-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer’s recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.
      f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section
with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.  
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are required, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 FIRE-RATED INSULATION SYSTEM INSTALLATION
A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
B. Insulate duct access panels and doors to achieve same fire rating as duct.
C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.12 FINISHES
A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
B. Do not field paint aluminum or stainless-steel jackets.

3.13 DUCT INSULATION SCHEDULE, GENERAL
A. Refer to the drawing schedule for insulation types & requirements.
B. Items Not Insulated:
   1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   4. Flexible duct connectors.
   5. Vibration-control devices.
   6. Factory-insulated access panels and doors.

3.14 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE
A. All underground piping requiring insulation shall be factory insulated. Field insulated underground piping is NOT allowed.

3.15 FIELD-APPLIED JACKET SCHEDULE
A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Piping, Exposed in all mechanical rooms:
   1. PVC: 20 mils thick.

D. Piping, Exposed, Outdoors:
   1. Aluminum Corrugated 0.016" thick up through 24" pipe size and 0.024 inch thick larger than 24" pipe size.

E. Generator Exhaust Piping:
   1. Smooth aluminum, 0.016" thick up through 12" pipe size, 0.024" thick for larger than 12"

END OF SECTION
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SECTION 231123 – NATURAL GAS PIPING

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. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Mechanical sleeve seals.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 SUBMITTALS

A. Product Data: For each type of the following:
1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.
5. Mechanical sleeve seals.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.5 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.


4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
   b. End Connections: Threaded or butt welding to match pipe.
   c. Lapped Face: Not permitted underground.
   e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
   a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:
   a. Steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Steel bolts, washers, and nuts.
   d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.

2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

   b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
   c. Aboveground Portion: PE transition fitting.
d. Outlet shall be threaded or flanged or suitable for welded connection.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to
      steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with
      corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or flanged or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
   a. PE body with molded-in, stainless-steel support ring.
   b. Buna-nitrile seals.
   c. Acetal collets.
   d. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe
   to PE pipe, or steel pipe to steel pipe.
   a. Fiber-reinforced plastic body.
   b. PE body tube.
   c. Buna-nitrile seals.
   d. Acetal collets.
   e. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE
   pipe, or steel pipe to steel pipe.
   a. Steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Steel bolts, washers, and nuts.
   d. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
   4. Corrugated stainless-steel tubing with polymer coating.
   5. Operating-Pressure Rating: 0.5 psig.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
   1. Copper-alloy convenience outlet and matching plug connector.
   2. Nitrile seals.
   3. Hand operated with automatic shutoff when disconnected.
   4. For indoor or outdoor applications.
   5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:
   1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 and smaller, flanged ends for NPS 2-1/2 and larger.
   3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent
      free area.

D. Basket Strainers:
   1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

E. T-Pattern Strainers:
1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.


C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M.
Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Brass Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane.
b. NIBCO.
c. Milwaukee.
3. Ball: Chrome-plated brass.
4. Stem: Brass; blowout proof.
5. Seats: Reinforced PTFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Kerotest Manufacturing Corp.
   b. Lyall, R. W. & Company, Inc.
   c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

2.5 PRESSURE REGULATORS

A. General Requirements:
1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.
5. Seat Disc: Nitrile rubber.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 DIELECTRIC FITTINGS

A. Dielectric Unions:
2. Combination fitting of copper alloy and ferrous materials.
3. Insulating materials suitable for natural gas.
4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:
2. Combination fitting of copper alloy and ferrous materials.
3. Insulating materials suitable for natural gas.
4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.
2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section “Earth Moving” for excavating, trenching, and backfilling.
   1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit. UNT Guidelines say all utilities shall be 36” or more below grade. Any exception to this should be approved by UNT.

C. Install underground, PE, natural-gas piping according to ASTM D2774.

D. Steel Piping with Protective Coating:
   1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
   3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

G. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

H. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install escutcheons at penetrations of interior walls, ceilings, and floors.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section “Penetration Firestopping.”

M. Verify final equipment locations for roughing-in.

N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
   1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
   a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:
   a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install natural-gas piping in solid walls or partitions.

S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

T. Connect branch piping from top or side of horizontal piping.

U. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

V. Do not use natural-gas piping as grounding electrode.

W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

C. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
   2. Bevel plain ends of steel pipe.
   3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
E. Brazed Joints: Construct joints according to AWS’s "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints (2" and smaller).
2. Steel pipe with wrought-steel fittings and welded joints (larger than 2").
3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for line pressure of 1 psig to 5 psig shall be two-piece, full port, brass ball valves. Provide valves rated for outdoor use as needed.

B. Valves for low pressure applications and equipment connections shall be lubricated plug valves.

C. Below grade PE distribution piping valves shall be PE ball valves.

3.12 TESTING

A. By UNT Design Guidelines, natural gas shall be tested at twice the working pressure, with a minimum of 3 psig.

END OF SECTION
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SECTION 232113 - HYDRONIC PIPING

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. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
   1. Hot-water heating piping.
   2. Chilled-water piping.
   3. Makeup-water piping.
   4. Condensate-drain piping.
   5. Blowdown-drain piping.
   6. Air-vent piping.
   7. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:
   1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
   1. Hot-Water Heating Piping: 150 psig at 200 deg F.
   2. Chilled-Water Piping: 150 psig at 200 deg F.
   3. Condensate-Drain Piping: 150 deg F.
   4. Blowdown-Drain Piping: 200 deg F.
   5. Air-Vent Piping: 200 deg F.
   6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 SUBMITTALS

A. Product Data: For each type of the following:
   1. Pressure-seal fittings.
   2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   3. Air control devices.
   5. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.
F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article. Piping shall be Schedule 40, U.S. domestic only. Foreign manufactured piping will not be accepted.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.


E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, Class 300 wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
   2. End Connections: Butt welding.
   3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Victaulic Company of America.
      b. Grinnell.
   2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
   3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

I. Steel Pressure-Seal Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Victaulic Company of America.
      b. Grinnell.
   2. Housing: Steel.
   3. O-Rings and Pipe Stop: EPDM.
   4. Tools: Manufacturer's special tool.
   5. Minimum 300-psig working-pressure rating at 230 deg F.

J. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 PRE-INSULATED PIPING

A. General
   1. Pre-insulated Piping – furnish a complete HDPE jacketed system of factory pre-insulated steel piping for the specified service. The jacket throughout the entire system shall incorporate electric fusion, butt fusion, or extrusion welding at all fittings, joint closures, or other points of connection. This shall create a jacket that is seamless throughout the entire system with the exception of anchors, whose water shed rings are sealed with a Raychem Dirax or Canusa GTS-65 wrap prohibiting the ingestion of water. If leak detection is required the system shall incorporate a copper wire, as specified below, to make the system leak detection ready. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the pre-insulated piping system manufacturer.
   2. A complete layout of the system, showing anchors, expansion provisions, and building entrance details, shall be provided by the pre-insulated pipe manufacturer. Means for expansion must be made in pipe offsets or loops. The system shall be pre-fabricated and pre-engineered to minimize the number of field welds.
   3. The system shall be FERO-THERM as manufactured by Thermacor Process, L.P., of Ft. Worth, Texas.
B. Carrier pipe shall be steel ASTM A-53, Grade B., ERW (Type E) or seamless (Type S), standard weight, Schedule 40. When practical, piping shall be provided in 40-foot double random lengths. All carbon steel pipe shall have ends cut square and beveled for butt-welding. Straight sections of factory-insulated pipe shall have 6” of exposed pipe at each end for field joint fabrication.

C. Insulation shall be polyurethane foam either spray applied or high pressure injected with one shot into the annular space between carrier pipe and jacket. Insulation shall be rigid, 90%-95% closed cell polyurethane with a 2.0 to 3.0 lbs. per cubic foot density and coefficient of thermal conductivity (K-factor) of 0.15 @ 75 degrees F. and shall conform to ASTM C-591. Maximum operating temperature shall not exceed 250 degrees F. Insulation thickness shall be specified by calling out appropriate carrier pipe and jacket size combinations as listed on Drawing FTSG 7.103.

D. Jacketing material shall be extruded, black, high density polyethylene (HDPE), having a minimum wall thickness of 125 mils. The jacket throughout the entire system shall incorporate electric fusion, butt fusion, or extrusion welding at all fittings, joint closures, or other points of connection. This shall create a jacket that is seamless throughout the entire system with the exception of anchors, whose water shed rings are sealed with a Raychem Dirax or Canusa GTS-65 wrap prohibiting the ingression of water. The inner surface of the HDPE jacket shall be oxidized by means of corona treatment, flame treatment (patent pending), or other approved methods. This will ensure a secure bond between the jacket and foam insulation, preventing any ingression of water at the jacket/foam interface.

E. Straight run joints are insulated using polyurethane foam to the thickness specified, jacketed with a full length HDPE sleeve that incorporates electro-fusion welding at all seams to create a pressure testable joint closure, a Canusa pressure testable Supercase closure, or Raychem Rayjoint pressure testable closure. The joint will be pressure tested at 5 psi for 5 minutes while simultaneously soap tested at the joint closure’s seams for possible leaks. After passing the pressure test, the field joint is insulated and a closure plug is frictionally welded (as per specified joint closure instructions) over the foam holes. All joint closures and insulation shall occur at straight sections of pipe.

F. Fittings are factory pre-fabricated and pre-insulated with polyurethane foam to the thickness specified and jacketed with a one-piece seamless molded HDPE fitting cover, a butt fusion welded, or an extrusion welded and mitered HDPE jacket. NO TAPING OR HOT AIR WELDING SHALL BE ALLOWED. All fitting jackets/covers shall be connected to the straight lengths of pipe by electrofusion, butt fusion, or extrusion welding. Carrier pipe fittings shall be butt-welded. Fittings include expansion loops, elbows, tees, reducers, and anchors. Elbows, loops, offsets, or any other direction changes shall conform to the standards set by ASME B31.1, Code for Power Piping.

G. Expansion/contraction compensation will be accomplished utilizing factory pre-fabricated and pre-insulated expansion elbows, Z-bends, expansion loops, and anchors specifically designed for the intended application. External expansion compensation utilizing flexible expansion pads (minimum one-inch thickness), extending on either side, both inside and outside the radius of the fittings used, with all fittings having expansion in excess of 1/2”.

H. Pre-engineered systems shall be provided with all straight pipe and fittings factory pre-insulated and pre-fabricated to job dimensions.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions, Flanges, Couplings and Nipples:
   1. Refer to Division 22, "Domestic Water Piping Specialties" for products.

2.6 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett Domestic Pump; a division of ITT Industries.
      c. Flow Design Inc.
      d. Gerard Engineering Co.
      e. Griswold Controls.
      f. Taco.
      2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
      3. Ball: Brass or stainless steel.
      4. Plug: Resin.
      5. Seat: PTFE.
      6. End Connections: Threaded or socket.
      8. Handle Style: Lever, with memory stop to retain set position.
      10. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett Domestic Pump; a division of ITT Industries.
      c. Flow Design Inc.
      d. Gerard Engineering Co.
      e. Griswold Controls.
      f. Taco.
      g. Tour & Andersson; available through Victaulic Company of America.
      h. Grinnell
      2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
      3. Ball: Brass or stainless steel.
      5. Disc: Glass and carbon-filled PTFE.
      6. Seat: PTFE.
      7. End Connections: Flanged or grooved.
      9. Handle Style: Lever, with memory stop to retain set position.
11. Maximum Operating Temperature: 250 deg F.

E. Automatic Flow-Control Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flow Design Inc.
      b. Griswold Controls.
   2. Body: Brass or ferrous metal.
   3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
   4. Combination Assemblies: Include bronze or brass-alloy ball valve.
   5. Identification Tag: Marked with zone identification, valve number, and flow rate.
   6. Size: Same as pipe in which installed.
   7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
   9. Maximum Operating Temperature: 250 deg F.

F. Pressure Independent Control Valve/Flow Limiter:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bell & Gossett
   2. Body: Brass or ductile iron.
   4. Valve Assembly: Field adjustable, lockable dial with 100% authority at all times. Provide full stroke control regardless of the GPM dial setting.
   5. Actuator: 0 – 10V modulation.
   6. Accessories: Extended temperature/pressure ports.
   7. Performance: Maintain constant flow, plus or minus 5% of GPM setting, within the valve's operating range.
   9. Maximum operating temperature: 248 degrees F.

2.7 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amtrol, Inc.
   2. Armstrong Pumps, Inc.
   3. Bell & Gossett Domestic Pump; a division of ITT Industries.
   4. Taco.

B. Manual Air Vents:
   1. Body: Bronze.
   2. Internal Parts: Nonferrous.
   3. Operator: Screwdriver or thumbscrew.
   4. Inlet Connection: NPS 1/2.
   7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:
   1. Body: Bronze or cast iron.
   2. Internal Parts: Nonferrous.
   4. Inlet Connection: NPS 1/2.
   7. Maximum Operating Temperature: 240 deg F.

D. Diaphragm-Type Expansion Tanks:
   1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.

E. Tangential-Type Air Separators:
   1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
   2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
   3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
   5. Size: Match system flow capacity.

F. In-Line Air Separators:
   1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
   3. Maximum Operating Temperature: Up to 300 deg F.

G. Air Purgers:
   1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
   3. Maximum Operating Temperature: 250 deg F.

2.8 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 175-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves. Provide Garrett-Callahan Co. Model #5018.
   1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment. Perform a water analysis and provide adequate treatment for the systems indicated on the drawings.

B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.9 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:
   1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 and smaller; flanged or grooved ends for NPS 2-1/2 and larger.
   3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

B. Basket Strainers:
   1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
   3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.

C. T-Pattern Strainers:
   1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
   2. End Connections: Grooved ends.
   3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
   4. CWP Rating: 750 psig.
D. Stainless-Steel Bellow, Flexible Connectors:
   2. End Connections: Threaded or flanged to match equipment connected.
   4. CWP Rating: 150 psig.
   5. Maximum Operating Temperature: 250 deg F.

E. Spherical, Rubber, Flexible Connectors:
   2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
   4. CWP Rating: 150 psig.
   5. Maximum Operating Temperature: 250 deg F.

F. Expansion fittings are specified in Division 23 Section “Expansion Fittings and Loops for HVAC Piping.”

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
   2. Schedule 40 black steel pipe; Class 2000 PSI, malleable-iron or cast iron fittings; threaded fittings.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
   2. Schedule 40 black steel pipe; Class 2000 PSI, butt welding fittings. Mechanically grooved-end fittings and couplings may be used in mechanical rooms.
   3. Grooved type couplings and fittings may not be used at risers or concealed areas.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
   2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be the following:
   1. Schedule 40 through 10-inch and 30 above 10-inch steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
   2. Schedule 40 through 10-inch and 30 above 10-inch steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

E. Chilled-water piping installed below grade, within the building perimeter, within sleeves shall be the following:
   1. Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use tubing without joints.

F. Hot or chilled water piping belowground shall be:
   1. Pre-insulated piping with steel carrier pipe, polyurethane insulation and HDPE jacketing, designed for direct-buried installation.

G. Makeup-water piping installed aboveground shall be the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

H. Makeup-Water Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

I. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
J. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

K. Air-Vent Piping:
   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer’s written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

L. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer’s written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated orifice, automatic flow-control, or pressure independent control valve/flow limiter where detailed on the drawings. Refer to drawings/details for specific installation of each type of valve. At a minimum, install flow control valves:
   1. At each branch connection to return main.
   2. In the return pipe of each heating or cooling terminal.
   3. Refer to drawings/details for specific installation of each type of valve.

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.
K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

V. B.A.S. temperature control devices requiring installation in piping such as motorized valves, sensors, etc., shall be installed by mechanical contractor.

W. Pre-insulated below grade piping:
   1. Underground systems shall be buried in a trench not less than two feet deeper than the top of the pipe and not less than eighteen inches wider than the combined O.D. of all piping systems. A minimum thickness of 24 inches of compacted backfill placed over the top of the pipe will meet H-20 highway loading. The minimum cover on top of piping shall be 36".
   2. Backfilling shall be done with sand 6" below the casing and 1' above. Engineer-approved backfill may be used to fill the rest of the trench. This material should be free of rocks, roots, large clods, or anything that could cause damage to the jacket.
   3. A hydrostatic pressure test of the carrier pipe shall be performed per the engineer’s specification with a factory recommendation of one and one-half times the normal system operating pressure for not less than two hours. Prior to testing, field verify central plant working pressure. Care shall be taken to insure all trapped air is removed from the system prior to the test. Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.
   4. Field service is required and will be provided by a certified manufacturer’s representative or company field service technician. The technician will be available at the job a minimum of one day (or more if required by job size) to check unloading, storing, and handling of pipe, pipe installation, pressure testing, field joint insulation, and backfilling techniques.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
   7. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
   8. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
   9. NPS 4: Maximum span, 14 feet; minimum rod size, 5/8 inch.
  10. NPS 5: Maximum span, 16 feet; minimum rod size, 5/8 inch.
  11. NPS 6: Maximum span, 17 feet; minimum rod size, 3/4 inch.
  12. NPS 8: Maximum span, 19 feet; minimum rod size, 3/4 inch.
  13. NPS 10: Maximum span, 22 feet; minimum rod size, 7/8 inch.
  14. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
  15. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
  16. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
  17. NPS 18: Maximum span, 28 feet; minimum rod size, 1 inch.
  18. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

D. Install hangers for draw-temper copper tubing with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. NPS 2: Maximum span, 8 feet; minimum rod size, 5/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer’s written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

K. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
   1. Install tank fittings that are shipped loose.
   2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

I. Strainer Schedule:

<table>
<thead>
<tr>
<th>Steel/Iron Piping Systems</th>
<th>Cast Iron</th>
<th>Steel</th>
<th>Bronze</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Y Basket</td>
<td>Y Basket</td>
<td>Y Basket</td>
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<tr>
<td>150 psig &amp; less</td>
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<tr>
<td>2-1/2” &amp; smaller</td>
<td>11</td>
<td>145</td>
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<tr>
<td>3” thru 12”</td>
<td>751</td>
<td>165</td>
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<tr>
<td>14” thru 24”</td>
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<td>151 thru 400 psig:</td>
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<td>2-1/2” &amp; smaller</td>
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<td>3” thru 12”</td>
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<tr>
<td>14” thru 24”</td>
<td>--</td>
<td>762</td>
<td>186</td>
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</table>
### 3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section “Meters and Gages for HVAC Piping.”

### 3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the water within acceptable limits.

B. Prepare a formal report detailing the results of the water analysis and proposed water treatment. Maintain a reasonable pH, alkalinity, corrosion inhibitor and microbiological growth.

C. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

D. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

### 3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system’s working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical
runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, “Building Services Piping.”

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:
   1. Open manual valves fully.
   2. Inspect pumps for proper rotation.
   3. Set makeup pressure-reducing valves for required system pressure.
   4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
   5. Set temperature controls so all coils are calling for full flow.
   6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
   7. Verify lubrication of motors and bearings.

END OF SECTION
SECTION 232300 - REFRIGERANT PIPING

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. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-134a:

B. Line Test Pressure for Refrigerant R-407C:

C. Line Test Pressure for Refrigerant R-410A:

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
   1. Thermostatic expansion valves.
   2. Solenoid valves.
   3. Hot-gas bypass valves.
   4. Filter dryers.
   5. Strainers.
   6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
   1. Shop Drawing Scale: 1/4 inch equals 1 foot.
   2. Refrigerant piping indicated or described on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.
B. Wrought-Copper Fittings: ASME B16.22.
C. Wrought-Copper Unions: ASME B16.22.
D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
E. Brazing Filler Metals: AWS A5.8.
F. Flexible Connectors:
   2. End Connections: Socket ends.
   3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch long assembly.
   5. Maximum Operating Temperature: 250 deg F.

2.2 PIPE ACCESSORIES

A. Provide valves and accessories shown/described on the drawings or as required to support and control the refrigeration system for each application.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Suction Lines, Liquid and Hot Gas NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
B. Suction Lines, Liquid and Hot Gas NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install packed-angle valves in suction and discharge lines of compressor.
B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
   1. Solenoid valves.
   2. Thermostatic expansion valves.
   3. Hot-gas bypass valves.
   4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.
I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
   1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
   2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
   a. Fill system with nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
   d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

B. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Open shutoff valves in condenser water circuit.
   2. Verify that compressor oil level is correct.
   3. Open compressor suction and discharge valves.
   4. Open refrigerant valves except bypass valves that are used for other purposes.
   5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

**END OF SECTION**
SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
   2. Double-wall rectangular ducts and fittings.
   4. Double-wall round ducts and fittings.
   5. Sheet metal materials.
   6. Duct liner.
   7. Sealants and gaskets.
   8. Hangers and supports.

B. Related Sections:
   1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. LEED Submittals:
   1. Product Data for Prerequisite IEQ-Minimum Indoor Air Quality Performance: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   2. Product Data for Prerequisite EA-Minimum Energy Performance: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
   3. Leakage Test Report for Prerequisite EA-Minimum Energy Performance: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
   4. Duct-Cleaning Test Report for Prerequisite IEQ-Minimum Indoor Air Quality Performance: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-Up."
   5. Product Data for Credit IEQ-Low-Emitting Materials: For adhesives and sealants, including printed statement of VOC content.

B. Shop Drawings: Detail, 1/4" – 1'-0" scale, the ductwork layout with sizes, configuration, liner material and static pressure classes, elevation of ductwork, reinforcement/spacing, seam and joint construction,
penetrations through fire-rated and other partitions, locations of duct accessories including dampers, turning vanes, access doors and access panels, equipment supports and foundations. Out of scale drawings showing actual dimensions will not be acceptable. Shop drawings shall show coordination with all other building trades.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

C. The ductwork shall be guaranteed for a period of one (1) year from and after the date of final acceptance of the job, against noise, chatter, whistling and vibration, and shall be guaranteed to be free from pulsation under all conditions of operation. After each system is in operation, should any of these defects occur, the components in which they occur shall either be removed and replaced or reinforced as directed by the Architect.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and
with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.

F. Inner Duct: Minimum 0.028-inch solid sheet steel.

G. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, " Traverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated. Ducts less than or equal to 1" SMACNA pressure class may be spiral or snap-lock type. Ducts greater than 1" SMACNA pressure class shall all be spiral only.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Inner Duct: Minimum 0.028-inch solid sheet steel.
C. **Interstitial Insulation:** Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
   3. Coat insulation with antimicrobial coating.
   4. Cover insulation with polyester film complying with UL 181, Class 1.

### 2.5 SHEET METAL MATERIALS

A. **General Material Requirements:** Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Unless noted otherwise in these specifications or on the drawings, all ductwork shall be G90 galvanized steel.

### 2.6 DUCT LINER

A. **Fibrous-Glass Duct Liner:** Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. **Maximum Thermal Conductivity:**
      a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
      a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. **Cupped-Head, Capacitor-Discharge-Weld Pins:** Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   4. **Insulation-Retaining Washers:** Self-locking washers formed from 0.016-inch- thick; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

B. **Closed-Cell Flexible Elastomeric Duct Liner:** Comply with ASTM C534, Type I sheet material.
   1. **Maximum Thermal Conductivity:**
      a. 0.28 Btu in/ft² at 75 degrees F, with antimicrobial product protection.

C. **Shop Application of Duct Liner:** Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

### 2.7 SEALANT AND GASKETS

A. **General Sealant and Gasket Requirements:** Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

### 2.8 HANGERS AND SUPPORTS

A. **Hanger Rods for Noncorrosive Environments:** Cadmium-plated steel rods and nuts.

B. **Hanger Rods for Corrosive Environments:** Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
C. **Cable and Rod Sizes:** Comply with SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible,” Table 4-1, “Rectangular Duct Hangers Minimum Size,” and Table 4-2, “Minimum Hanger Sizes for Round Duct.”

D. **Steel Cables for Galvanized-Steel Ducts:** Galvanized steel complying with ASTM A 603.

E. **Steel Cables for Stainless-Steel Ducts:** Stainless steel complying with ASTM A 492.

F. **Steel Cable End Connections:** Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. **Duct Attachments:** Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. **Trapeze and Riser Supports:**
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

**PART 3 - EXECUTION**

3.1 **DUCT INSTALLATION**

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible” unless otherwise indicated.

C. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

D. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

E. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

F. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures and directly over any electrical panel or transformer.

G. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

H. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section “Air Duct Accessories” for fire and smoke dampers.

I. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA’s “Duct Cleanliness for New Construction Guidelines”, intermediate level of cleanliness.
   1. Prevent damage and accumulation of dirt/debris during transportation.
   2. Store ducts on the jobsite in an area that is clean, dry and exposure to dust is minimized.
   3. Wipe internal surfaces of ductwork immediately prior to installation.
   4. Open ends on completed ductwork and overnight work-in-progress shall be sealed, regardless of the position.
3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease. Ducts with horizontal sections 75 feet or less shall be sloped a minimum of 2 percent to drain grease back to the hood. For ducts greater than 75 feet, horizontal slope a minimum of 8.3 percent.

B. Install fire-rated access panel assemblies, meeting IMC-2015, at each change in direction (not more than 10 feet from change in direction) and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 FIELD QUALITY CONTROL

A. Leakage Tests:
2. Test the following systems:
   a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

B. For all grease ducts perform a light test, per IMC-2015, to determine that all welded joints are liquid tight for the entire duct system. Grease ducts shall be leakage tested for the entire length of the duct system, per SMACNA HVAC Air Duct Leakage Test Manual.

C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Clean any portion of the duct system that contains dust, dirt or debris.

3.7 DUCT SCHEDULE

A. Supply Ducts:
1. Ducts Connected to the Discharge Side of Air Terminal Units:
   a. Pressure Class: Positive 1-inch wg.
   b. Minimum SMACNA Seal Class: A.
2. Ducts Connected to Low Pressure Constant-Volume AHU, Furnaces and Other Similar Units:
   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
3. Ducts Connected to Medium Pressure Variable-Air-Volume AHU or Fans:
   a. Pressure Class: Positive 3-inch wg. If the drawings or schedules indicate a duct system operating in excess of 3-inch wg provide SMACNA pressure class 4-inch.
   b. Minimum SMACNA Seal Class: A.

B. Return Ducts:
1. All Return Ducts:
   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: A.

C. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
   a. Pressure Class: Negative 2-inch wg.
   b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96:
   a. Exposed to View: 18 gauge, Type 304, stainless-steel sheet, minimum.
   b. Concealed: 16 gauge black steel, minimum.
   c. External welded seams and joints, meeting requirements of IMC 2015.
   d. Pressure Class: Positive or negative 2-inch wg.
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.

3. Ducts Connected to Dishwasher Hoods; Locker rooms, shower areas and associated restrooms; other wet area exhaust systems:
   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 finish.
   c. Concealed: No. 2D finish.
   d. Welded seams and flanged joints with watertight EPDM gaskets.
   e. Pressure Class: Positive or negative 2-inch wg.
   f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   g. SMACNA Leakage Class: 3.

D. Liner (only where indicated here or on the drawings):
   1. Transfer Ducts: Fibrous glass, Type I, 1/2 inch thick or Closed-cell elastomeric, 1/2 inch thick.
   2. Where liner is used, increase the sheet metal dimensions to allow for the liner thickness. Dimensions on drawings are clear dimensions.

E. Double-Wall Duct Interstitial Insulation:
   1. All ducts shall be insulated per standard requirements to meet IECC 2015.

F. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
      a. Low Pressure (2" and Below)
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vaness and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
      b. Medium Pressure (3" and Higher):
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

G. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.
   2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
      a. Velocity 1000 fpm or Lower: 90-degree tap.
      b. Velocity 1000 or higher: Conical tap.

H. COORDINATION
   1. Fire Alarm and B.A.S. Temperature Control devices requiring installation in ductwork such as smoke detectors, air monitors, motorized dampers and sensors shall be installed by the mechanical subcontractor.
SECTION 233300 - AIR DUCT ACCESSORIES

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. Backdraft and pressure relief dampers.
   2. Barometric relief dampers.
   4. Fire dampers.
   5. Combination fire and smoke dampers.
   6. Duct silencers.
   7. Turning vanes.
   8. Remote damper operators.
   9. Duct-mounted access doors.
   10. Flexible connectors.
   11. Flexible ducts.
   12. Duct security bars.
   13. Duct accessory hardware.

B. Related Sections:
   1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
   2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. LEED Submittal:
   1. Product Data for Prerequisite IEQ-Minimum Indoor Air Quality Performance: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

1.4 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   2. Exposed-Surface Finish: Mill phosphatized.
C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. Nailor Industries Inc.
   4. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum System Pressure: As defined by the duct construction requirements.

D. Frame: 0.063-inch thick extruded aluminum 0.052-inch thick with welded corners and mounting flange.

E. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch thick, roll-formed aluminum with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Neoprene, mechanically locked.

H. Return Spring: Adjustable tension.

I. Bearings: Steel ball or synthetic pivot bushings.

J. Accessories:
   1. Adjustment device to permit setting for varying differential static pressure.
   2. Counterweights and spring-assist kits for vertical airflow installations.
   3. Electric actuators.
   4. Chain pulls.
   5. Screen Mounting: Front mounted in sleeve.
      a. Sleeve Thickness: 20-gage minimum.
      b. Sleeve Length: 6 inches minimum.
   6. Screen Mounting: Rear mounted.
   7. Screen Material: Aluminum.
   8. Screen Type: Insect.
   9. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. Nailor Industries Inc.
   4. Ruskin Company.
B. Suitable for horizontal or vertical mounting.

C. Maximum System Pressure: As defined by the duct construction requirements.

D. Frame: 0.063-inch- thick extruded aluminum, with welded corners and mounting flange.

E. Blades:
   1. Multiple, 0.025-inch- thick, roll-formed aluminum.
   3. Action: Parallel.
   5. Eccentrically pivoted.

F. Blade Seals: Neoprene.

G. Return Spring: Adjustable tension.

H. Accessories:
   1. Flange on intake.
   2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. Suitable for horizontal or vertical applications.
   2. Frames:
      a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   3. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized-steel, 0.064 inch thick.
   4. Bearings:
      a. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   5. Accessories
      a. Include locking device to hold single-blade dampers in a fixed position without vibration per UNT Design Guidelines.

B. Low-Leakage, Steel, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Warming and Ventilating; a division of Mestek, Inc.
      b. Nailor Industries Inc.
      c. Ruskin Company.
   2. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
   3. Suitable for horizontal or vertical applications.
   4. Frames:
      a. Galvanized-steel channels, 0.064 inch thick.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized, roll-formed steel, 0.064 inch thick.
   6. Bearings:
      a. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Accessories:
   a. Include locking device to hold single-blade dampers in a fixed position without vibration per UNT Design Guidelines.

2.5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Nailor Industries Inc.
   3. Prefco.
   4. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Fire Rating: 1-1/2 or 3 hours, depending upon fire rating equipment of wall or floor assembly.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners. Blades in the airstream are acceptable only in areas where the fire damper is directly preceded by a grille.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
   1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
   2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

H. Horizontal Damper: Include blade lock and stainless-steel closure spring.


2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Nailor Industries Inc.
   3. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4 inch w.g static pressure class and maximum 4000 fpm velocity.

D. Fire Rating: 1-1/2 or 3 hours, depending upon fire rating requirement of wall or floor assembly.

E. Frame: Multiple blade type fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Electric, resettable link and switch package, factory installed and tested.

G. Leakage Class 1 (8cfm/sf @ 4.0" wg.)

H. Damper Motors: Two-position action.
I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
   3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
   5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
   6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
   7. Electrical Connection: 115 V, single phase, 60 Hz.

J. Accessories:
   1. Auxiliary switches for signaling and/or position indication.
   2. Test and reset switches, damper mounted.

2.7 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Pottorff.
   2. IAC.

B. General Requirements:
   1. Factory fabricated.
   3. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.

C. LEED Requirement:
   1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.


E. Inner Casing and Baffles: ASTM A 653/A 653M, galvanized sheet metal, 26 gauge thick, and with 1/8-inch- diameter perforations.

F. Connection Sizes: Match connecting ductwork.

G. Principal Sound-Absorbing Mechanism:
   1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
   2. Film-lined type with fill material.
      a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
      b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
   3. Lining: Mylar.

H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
   1. Continuously weld joints.
   2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

I. Source Quality Control: Tested in accordance with ASTM E 477.
   1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
   2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.8 REMOTE DAMPER OPERATORS

A. Provide remote damper operators for controlling dampers located above gyp board or other inaccessible ceilings.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Pottorff.
   2. Ventfabrics, Inc.
   3. Young Regulator Company.

C. Description: Cable system designed for remote manual damper adjustment.

D. Tubing: Brass.

E. Cable: Stainless steel.

F. Ceiling Mounting: Coverplate shall be white.

2.9 DUCT-MOUNTED ACCESS DOORS

   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
      c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside handles.
      d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Flame Gard, Inc.
   3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. SEMCO Incorporated.
   5. AeroDyne Sound Control Co.

B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA’s "HVAC Duct Construction Standards – Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Double wall, airfoil shaped.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

   1. Minimum Weight: 24 oz./sq. yd.
   3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flexmaster U.S.A., Inc.
   2. McGill AirFlow LLC.
   3. Ward Industries, Inc.

B. Insulated Flexible Duct, Type 1: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 4-inch wg positive and 1.0-inch wg negative.
   3. Temperature Range: Minus 10 to plus 160 degrees F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Insulated Flexible Duct, Type 2: UL 181, Class 1, aluminum flexible duct; fibrous-glass insulation, polyethylene or aluminized vapor-barrier film.
1. Pressure Rating: 10-inch wg (2500 Pa) positive thru 16" diameter and 12-inch wg (3000 Pa) negative thru 16" diameter.
2. Maximum Air Velocity: 5500 fpm (27.5 m/s).
3. Temperature Range: Minus 20 to plus 250 degrees F (minus 29 to plus 121 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches, to suit duct size.

2.14 DUCT SECURITY BARS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carnes.
2. KEES, Inc.
3. Lloyd Industries, Inc.
4. Metal Form Manufacturing, Inc.
5. Price Industries.

B. Description: Field- or factory-fabricated and field-installed duct security bars.

C. Configuration:
1. Frame: 10 gage by 2 inches.
2. Sleeve: 3/16-inch, continuously welded steel frames with 1-by-1-by-3/16-inch angle frame factory welded to 1 end or furnished loose for field welding on other end. To be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.
3. Horizontal Bars: 1/2 inch.
4. Vertical Bars: 1/2 inch.
5. Bar Spacing: 6 inches.

2.15 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft or control dampers as indicated on the Drawings at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and fire smoke dampers according to UL listing.

H. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

I. Connect ducts to duct silencers rigidly.

J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Upstream from duct filters.
   3. At outdoor-air intakes and mixed-air plenums.
   4. At drain pans and seals.
   5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
   6. Adjacent to and close enough to fire or fire/smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   7. At each change in direction and at maximum 50-foot spacing.
   8. Upstream and downstream from turning vanes.
   9. Upstream or downstream from duct silencers.
   10. Control devices requiring inspection.
   11. Elsewhere as indicated.

K. Install access doors with swing against duct static pressure.

L. Access Door Sizes (minimum sizes)
   1. One-Hand or Inspection Access: 8 by 5 inches.
   2. Two-Hand Access: 12 by 6 inches.

M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

N. Install flexible connectors to connect ducts to equipment.

O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. Connect terminal units and other high pressure systems to supply ducts with maximum 12-inch lengths of flexible duct, Type 2. Do not use flexible ducts to change directions.

Q. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct, Type 1, clamped or strapped in place.
R. Connect flexible ducts to metal ducts with draw bands adhesive and sheet metal screws.

S. Install duct test holes where required for testing and balancing purposes.

T. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

B. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

END OF SECTION
SECTION 233423 - HVAC POWER VENTILATORS

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. This Section includes the following:
   1. Utility set fans.
   2. Centrifugal roof ventilators.
   3. Centrifugal wall ventilators.
   4. In-line centrifugal fans.
   5. Propeller fans.
   6. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.
1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. **Belts:** One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Fabricated of steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
   1. **Housing Discharge Arrangement:** Adjustable to eight standard positions.

D. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

E. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

F. Accessories:
   1. Inlet and Outlet: Flanged.
   2. **Companion Flanges:** Rolled flanges for duct connections of same material as housing.
   3. **Backdraft Dampers:** Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
   4. **Access Door:** Gasketed door in scroll with latch-type handles.
   5. **Drain Connections:** NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
   6. **Weather Hoods:** Weather resistant with stamped vents over motor and drive compartment.
   7. **Speed Controller:** Solid-state control to reduce speed from 100 to less than 50 percent.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
   1. **Upblast Units:** Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
   2. **Hinged Subbase:** Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
   1. **Fan Shaft:** Turned, ground, and polished steel; keyed to wheel hub.
   2. **Shaft Bearings:** Permanently lubricated, permanently sealed, self-aligning ball bearings.
   3. **Pulleys:** Cast-iron, adjustable-pitch motor pulley.
   4. **Fan and motor isolated from exhaust airstream.

F. Accessories:
   1. **Disconnect Switch:** Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Other accessories as listed on the drawing schedule.

G. Roof Curbs: 12" High Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

2.3 CENTRIFUGAL WALL VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

D. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
   1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   4. Fan and motor isolated from exhaust airstream.

F. Accessories:
   1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   3. Other accessories as listed on the drawing schedule.

2.4 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Description: In-line centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

F. Fan Wheels: Aluminum, backward inclined blades welded to aluminum hub.

2.5 PROPELLER FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.
C. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

D. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

E. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

F. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
   1. Service Factor Based on Fan Motor Size: 1.4.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
      a. Ball-Bearing Rating Life: ABMA 9, \( L_{10} \) of 100,000 hours.
   4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
   5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
   6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

G. Accessories:
   1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
   3. Wall Sleeve: Galvanized steel to match fan and accessory size.
   4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   5. Other accessories as listed on the drawings.

2.6 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:
   1. Accessories as listed in the drawing schedule.

2.7 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Motor controllers, except where they are to be mounted inside a motor control center or specifically identified and scheduled in Division 26 or on the drawings, shall be furnished by the M/C or P/C for installation by the E/C. Refer to Section 220513 for details.
2.8 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts, restrained elastomeric mounts, spring isolators or restrained spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

E. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.
   6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION
SECTION 233600 - AIR TERMINAL UNITS

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. Single-duct air terminal units.

1.3 PERFORMANCE REQUIREMENTS

1.4 SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
   1. Air terminal units.
   2. Liners and adhesives.
   3. Sealants and gaskets.

B. LEED Submittal:
   1. Product Data for Prerequisite IEQ-Minimum Indoor Air Quality Performance: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fan-Powered-Unit Filters: Furnish one spare filter for each filter installed.

PART 2 - PRODUCTS

2.1 SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown in the drawings.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel.
   1. Casing Lining (either Option a or b is acceptable):
      a. Casing Lining: Adhesive attached, 1-inch- thick fibrous-glass duct liner having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84. Cover lining with solid sheetmetal so that no fibers are exposed to air stream.
b. Casing Lining: Adhesive attached, 1-inch thick, closed cell foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

2. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with air tight gasket.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.

E. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

F. Controls:
1. Electric actuators, DDC controllers, and transducers shall be furnished by EMS contractor (See division 230900). All controls shall be delivered to air terminal manufacturer.
2. Air terminal manufacturer shall factory mount all devices and ship complete units to job sites.
3. Terminal unit manufacturer shall provide a flow cross in inlet and extend tubing from flow cross to controls provided by Section 230900.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.
1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflow, and ARI certification seal.

2.3 CONTROLS INTERFACE

A. Electric actuators, DDC controllers, and transducers shall be furnished under Section 230900 and sent to the terminal unit manufacturer. The terminal unit manufacturer shall factory mount the devices and connect all wiring and tubing in accordance with Drawings furnished under this Section; the terminal unit manufacturer shall furnish and install a 120/24 V transformer sized for three DDC controllers and toggle switch on a 4 x 4 electrical box securely fastened to the terminal unit on CAV/fan heat boxes and VAV/Fan heat boxes only. The terminal unit manufacturer shall furnish and install a flow cross in the inlets of the unit to measure the differential between the total and static pressures. Manufacturer shall extend the tubing from the flow cross and connect to the differential pressure transducer furnished under Section 230900. Manufacturer shall provide separate external total and static pressure connections (capped barbed tees) in the tubing for connection to a differential pressure gauge for field measurement of air flow quantity. The control sequences shall be as described below, and the terminal unit shall be shipped from the manufacturer with all necessary control devices to accomplish each sequence. The 24V power wiring for 24V DDC controllers on VAV boxes shall be extended from the 24V transformer on CAV/fan heat box by Section 230900. Room space temperature sensors and associated cabling shall be furnished and installed by Section 230900.

B. Sequence of Operation
1. VAV, CAV/Fan heat boxes and VAV/Fan heat boxes shall be DDC. Controllers shall be furnished by this section and factory installed by the terminal unit manufacturer. This section shall be responsible for the operational performance of the boxes. The terminal unit manufacturer shall remain responsible for the mechanical components of the boxes.
2. VAV Boxes: The DDC controller shall monitor the space temperature from a room space temperature sensor and modulate the normally open damper to maintain the setpoint (adjustable).
3. CAV/Fan Heat Boxes and VAV/Fan heat boxes: The DDC controller shall monitor the space temperature from a room space temperature sensor and modulate the normally open damper and staged heat in sequence. CAV/Fan heat boxes Fan shall run continually. Units shall have minimum primary air flow stops set at 20% of the design airflow rate.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible,” Chapter 4, “Hangers and Supports.”

3.3 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping,” connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Make connections to air terminal unit inlets with flexible ductwork complying with requirements in Division 23 Section "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer’s written instructions.

2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.

3. Verify that controls and control enclosure are accessible.

4. Verify that control connections are complete.

5. Verify that nameplate and identification tag are visible.

6. Verify that controls respond to inputs as specified.

END OF SECTION
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SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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. Related Sections:
   1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
   2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 AIR INLETS AND OUTLETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the approved manufacturers shown on the drawings.

B. Grilles, registers, ceiling outlets, and ceiling inlets shall be as indicated in the schedule on the Drawings.

C. Verify the type of ceiling system and material into which each of the air inlets and outlets are to be installed, and provide equipment that properly "fits" whether specifically so indicated or not on the Drawings.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air
volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Locations of outlets shown on the drawings are approximate; they shall be coordinated with other trades to make symmetrical patterns, and shall be governed by the established pattern of the lighting fixtures or architectural reflected ceiling plan. Where a reflected ceiling plan is included in the architectural drawings, locations of all devices as shown thereon shall govern.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION
SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.
   B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.
   B. Shop Drawings: Where not specifically mentioned in subsequent sections, provide drawings for equipment arrangements, terminal boards, large cabinets and enclosures, local communications systems and modular wiring systems.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
   
B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section “Access Doors and Frames.”

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section “Penetration Firestopping”.

E. Coordinate chases, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follows.
   1. Set inserts and sleeves in poured-in place concrete, masonry work, and other structural components as they are constructed.
F. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

G. Coordinate electrical service connections to components furnished by utility companies.
   1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
   2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

H. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

I. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

J. In order to make the submittal review process more efficient for all parties, all MEP submittal data shall be reviewed on a designated “Submittal Review Day.” The “Submittal Review Day” will consist of having the Engineer, General Contractor, Mechanical Contractor, Plumbing Contractor, and Electrical Contractor review the submittals together, in the same room. The Architect and owner’s representative(s) will be invited to attend the “Submittal Review Day.” Key Manufacturer’s Representatives shall attend the review or be available by phone for immediate response to questions and/or comments. All submittals will be reviewed and stamped by the Engineer the same day. The Contractor is responsible for setting time and place for this review and inviting all required parties. All parties will be given a minimum of seven (7) days notice.

1.6 GENERAL

A. For Products specified by reference to an association or trade standard, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

B. The date of the standard is that in effect on the date of issue of Contract Documents, except when a specific publication date is specified. Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

1.7 SCHEDULE OF ABBREVIATIONS

A. Reference standards are listed in various sections using abbreviations contained below:
   - ANSI: American National Standards Institute
   - ASTM: American Society for Testing and Materials
   - EGSMA: Engine Generator Sales Manufacturers Association
   - ETL: Electrical Testing Laboratories
   - ICEA: Insulated Cable Engineers Association
   - IEEE: Institute of Electrical and Electronic Engineers
   - IES: Illuminating Engineering Society
   - NBS: National Bureau of Standards
   - NEC: National Electrical Code
   - NECA: National Electrical Contractors Association
   - NEMA: National Electrical Manufacturers’ Association
   - NETA: International Electrical Testing Association
   - NFPA: National Fire Protection Association
   - CSHA: Occupation Safety Health Administration
   - UL: Underwriters Laboratories

1.8 OPERATION AND CONTROL CHARACTERISTICS OF EQUIPMENT

A. The operation and control characteristics of each item of equipment scheduled, noted and/or indicated on the plans and specifications are based on a particular manufacturer and model. While other manufacturers or models may be acceptable, it is the responsibility of the Contractor to verify that the
operation and controls characteristics for the equipment he proposes to provide match those indicated. In the instance where the equipment he proposes to provide has different operation and controls characteristics, the Contractor AT NO COST TO THE OWNER shall provide the required operation and controls characteristics required. All modifications to provide the operation and control characteristics shall be coordinated by the Contractor with the Engineer.

B. Motor controllers, except where they are to be mounted inside a motor control center or specifically identified and scheduled in Division 26 or on the drawings, shall be furnished by the M/C or P/C for installation by the E/C. Refer to Section 220513 for details.

C. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.

D. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.

E. The date of acceptance by the Architect, for beneficial use by the Owner, shall be the beginning date of the warranty period.

1.9 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of each item of equipment shown on the Drawings is based on the dimensions of a particular manufacturer, or approximate dimensions for “generic” equipment. While other manufacturers may be acceptable, it shall be the responsibility of the Contractor to determine whether or not the equipment he proposes to furnish will fit into the available space. Shop drawings shall be prepared to indicate a suitable arrangement.

B. Install equipment in a manner to permit access to all surfaces. Install switches, circuit breakers, relays, ballasts, and other accessory items, and all auxiliary devices in a position to allow removal for service without requiring the disassembly of another part. Alternative arrangements deemed “suitable” must conform to Codes and provide at least as much access and working space clearance as indicated on Bid Drawings.

C. Large equipment assemblies and components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. Such equipment shall be ordered early on, sufficient to allow arrival for timely installation. Contact the Architect should problems be expected in this regard. The equipment shall be protected until hazards of damage to the equipment, including dust and moisture, are eliminated.

1.10 OPERATING AND MAINTENANCE MANUALS

A. Manuals shall be submitted which contain the following:
   1. Description of the system provided.
      a. Handling, storage, and installation instructions.
      b. Detailed description of the function of each principal component of the systems or equipment, including necessary wiring diagrams.
   2. Operating procedures:
      a. Pre startup activities required.
      b. Startup.
      c. Normal operation.
      d. Emergency shutdown.
      e. Normal shutdown.
      f. Trouble-shooting guide.
   3. Maintenance:
      a. Preventative and repair maintenance procedures.
      b. Complete spare parts list with cross reference to original equipment manufacturer part number.
   4. Safety and environmental considerations.
5. Other data required elsewhere in the specifications.

B. Three copies of the manuals shall be provided within sufficient time to allow for training of Owner's personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion or building turn over, whichever comes first. Submit the remaining three corrected copies within 15 days after review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

C. The manuals shall be provided in three-ring side binders with durable plastic covers.

D. The manuals shall contain a detailed table of contents and have tab dividers for major sections and special equipment.

E. The Owner will not accept any training or equipment unless the maintenance manuals are received a minimum of 10 working days prior to request for Training/Turnover.

1.11 START-UP EQUIPMENT AND SYSTEMS

A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.

B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

1.12 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Architect to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorizes representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.

1.13 AS-BUILT DRAWINGS

A. The Contractor shall, during the progress of the job, keep a set of record prints on which he shall mark all changes. After completion of a CADD release form by the Contractor and near the conclusion of the job, the Architect will provide the Contractor with one set of AutoCAD electronic files of the Mechanical, Plumbing, and Electrical Drawings. The Contractor shall draft on these electronic files all changes made during the progress of the work and return them and one set of paper plans with the changes to the Architect as "As-Built Drawings".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Each item of equipment furnished on this project shall have local representation, factory-authorized service and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 50 miles of the project site."

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FIRESTOPPING

A. Provide firestopping in sealing of penetrations in fire-rated construction, horizontal and vertical, including the following materials:

1. Foam: Dow Corning Firestop silicone RTV foam, liquid component Part A (black) and liquid component Part B (off-white).

2. Sealant: 3M 1000NS and 1003SL silicone adhesive sealant, single component, neutral cure, and non-slumping.

3. Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by the applicator.

B. Mixes shall conform to the manufacturer's directions.

PART 3 - EXECUTION

3.1 ELECTRICAL DEMOLITION

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 electrical, communications, alarm, and other existing systems, and maintain existing functions in service except for scheduled disruptions. 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.

C. Scheduling of Disruptions: Seek and obtain approval two weeks in advance of event for date, starting time, and duration of each required disruption.

D. Notice of Disruption: Date, time and duration of each disruption shall be subject to the Owner's prior approval, and shall include the following information in the form of a memorandum submitted by the Contractor to the Architect for approval by the Owner.

<table>
<thead>
<tr>
<th>Facility/System</th>
<th>Date</th>
<th>Starting Time</th>
<th>Duration</th>
</tr>
</thead>
</table>

E. Emergency disruptions: When circumstances preclude obtaining advance approval as specified above; make request immediately on knowledge of the requirement, and perform work so as to cause the minimum amount of disruption, for the minimum duration.

F. Notification: Notify the Architect and the Owner immediately by telephone and then in writing, as changes and additions to the scheduled disruption requirements become known.

G. Duration: Complete as large a portion of the work as possible before initiating disruption and perform only that work necessary so as to minimize duration of disruption. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal service.

3.2 GENERAL

A. The Drawings and specifications are intended to accomplish certain objectives. These documents do not purport to indicate methods the Contractor is to use in accomplishing the objectives. They show conduit and wire sizes and they describe the various systems. These documents describe and size equipment, its general location, usage, support and auxiliary requirements. They also describe most, but not all, of the materials and their usage for this project.

B. Contract Documents do not, however, detail certain job requirements. In most instances they do not show exact layouts, locations or elevations of any fixtures, conduits, anchors, sleeves, hangers, slots, holes, outlets, inserts, elbows, or fittings. They do not show final precise location of equipment by dimension in most instances, or manufacturer’s requirements for proper installation, operation and maintenance or manufacturer’s requirements for proper installation, operation, and maintenance.

C. In general, conduit in finished areas of the building shall be run concealed in chases, walls, floor slabs, furrings, and above suspended ceilings, unless noted or indicated otherwise. Should any condition arise which would cause any conduit to be exposed in finished area, it shall be immediately called to the Architect's attention and correction of the condition shall be made in accordance with the Architect's instruction. Runs of conduit shall be grouped wherever it is feasible to do so. Conduits shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing.
   1. In unfinished spaces such as equipment rooms, conduit shall be installed parallel to the building plates, shall be run as high as possible, and shall be square to the building and securely supported. A high quality of workmanship is expected.
   2. Conduits shall not be run above grade, outside, exposed on any external walls, or across the roof exposed, without the express written permission of the Architect.
   3. Conduit openings shall be capped during construction until the systems are closed with final connections.

D. The exact location of each item shall be determined by reference to the project Contract Drawings, and to details, equipment drawings, roughing-in drawings, by measurement at the building, and in cooperation with the various trades. In congested spaces (such as below raised floors), Contractor shall develop a special hierarchy to coordinate electrical with other trades. Contact Architect for additional guidance.
Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

E. Coordinate proper locations and sizes of slots, holes or openings in the building structure pertaining to this work, and for the correct location of sleeves. Place inserts to accommodate the ultimate installation of hangers in the forms, and set sleeves in forms before concrete is poured, and in masonry walls while they are under construction. Concealed lines shall be installed as required by the pace of the job to precede the general construction.

F. Except for items that are furnished with factory installed integral motors, an electric motor of required size and electrical characteristics will be provided under Division 22 and 23 for each item of motor-driven equipment as specified in Sections 22500 and 230500. Complete the electrical installation of these motors in accordance with approved wiring diagrams and instructions. Motor feeders and branch circuits conductors shall be copper throughout.

G. Provide the setting and electrical connections for each item of control equipment. Connections shall be made in accordance with approved wiring diagrams and instructions.

H. Provide the correct size heater elements or solid-state overload device settings to protect each motor and allow it to operate based on motor load (full load current) of the actual motor installed in each instance, and ambient temperature experienced on each individual motor.

I. Provide electrical connections to each item of equipment requiring such connections.

J. Final connection shall be made with at least two feet (no more than six feet) of liquid-tight flexible conduit.

K. Where possible, terminate conduits in conduit boxes on motors. Where motors are not provided with conduit boxes, terminate the conduits in conduit fittings at motors.

L. Where disconnect switches are not provided integral with the control equipment for motors, provide disconnect switches required by these Specifications (Refer to Division 22 and 23) and the NEC. Generally, disconnect switches shall be heavy-duty, enclosed, externally operable, horsepower rated switches with voidable cover interlocks of adequate capacity for the duty intended. Each disconnect switch shall be installed as close as possible to the motor or controller it serves (and in no case farther than 50 feet from the motor or controller served), and shall be within sight of the motor or controller served. Use horsepower rated toggle switches for small fractional horsepower motors. Use weatherproof enclosures outdoors and at cooling towers.

3.3 SALVAGE, DEMOLITION AND RELOCATION

A. General:
   1. Modify, remove, or relocate materials and items indicated on the Drawings or required by the installation of new facilities.
   2. Remove demolition material from the site and deliver salvage materials to destinations on the premises, as directed.

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 and to restore to good operating order.
   5. Perform the relocation work in accordance with applicable Sections of these Specifications, utilizing skilled workers.

C. Relocating Devices: Remove and reinstall in locations designated by the Architect temperature control system devices, relays, wire, conduit, fixtures, equipment and other devices required for the operation of the various systems that are installed in existing-to-be-removed construction.
3.4 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 TOUCH UP PAINT

A. Equipment: Equipment manufacturer’s paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

C. Non-equipment Surfaces: Match type and color undamaged, existing adjacent finish.

3.9 EDGE GUARD

A. Provide protective trim for exposed and unfinished edges of metal where conductors are subject to damage, to include, but not limited to, the following:
   1. Panelboards
   2. Junction boxes
   3. Switchgear
   4. Disconnect switches
   5. Control cabinets
   6. Mechanical unit
   7. Starters

B. Protective trim shall be:
   1. Vinyl covered.
   2. Bonded to extruded PVC.
   3. Flexible, segmented metal core surrounded by 0.018” thick cold rolled steel.
   4. Smooth finish.
   5. Heat resistance of 150 degrees F for continuous use.
   7. Equal to Protective Trim products available from McMaster-Carr under “Protective Bumpers and Trim” section.

3.10 CONSTRUCTION REQUIREMENTS

A. The Drawings and Specifications are intended to accomplish certain objectives. These documents do not purport to indicate methods the Contractor is to use in accomplishing the objectives. They show conduit and wire sizes and they describe the various systems. These documents describe and size equipment, its general location, usage, support and auxiliary requirements. They also describe most, but not all, of the materials and their usage for this project.

B. Contract Documents do not, however, detail certain job requirements. In most instances, they do not show exact layouts, locations or elevations of any fixtures, conduits, anchors, sleeves, hangers, slots, holes, outlets, inserts, elbows, or fittings. They do not show final precise location of equipment by dimension in most instances.

C. In general, conduit in finished areas of the building shall be run concealed in chases, walls, floor slabs, furrings, and above suspended ceilings, unless noted or indicated otherwise. Should any condition arise
which would cause any conduit to be exposed in finished area, it shall be immediately called to the Architect's attention and correction of the condition shall be made in accordance with the Architect's instruction. Runs of conduit shall be grouped wherever it is feasible to do so. Conduits shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing.

1. In unfinished spaces such as equipment rooms, conduit shall be installed parallel to the building plates, shall be run as high as possible, and shall be square to the building and securely supported. A high quality of workmanship is expected.
2. Conduits shall not be run above grade, outside, exposed on any external walls, or across the roof exposed, without the express written permission of the Architect.
3. Conduit openings shall be capped during construction until the systems are closed with final connections.

D. The exact location of each item shall be determined by reference to the project Contract Drawings, and to details, equipment drawings, roughing-in drawings, by measurement at the building, and in cooperation with the various trades. In congested spaces (such as below raised floors), Contractor shall develop a special hierarchy to coordinate electrical with other trades. Contact Architect for additional guidance. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

E. Coordinate proper locations and sizes of slots, holes or openings in the building structure pertaining to this work, and for the correct location of sleeves. Place inserts to accommodate the ultimate installation of hangers in the forms, and set sleeves in forms before concrete is poured, and in masonry walls while they are under construction. Concealed lines shall be installed as required by the pace of the job to precede the general construction.

3.11 EQUIPMENT FOUNDATIONS, HANGERS AND SUPPORTS

A. For floor-mounted electrical equipment, provide concrete house-keeping pads not less than 3-1/2 inches thick, reinforced with No. 3 dowels and No. 3 bars 2’-0” on center each way. Pour housekeeping pads in forms built of new-dressed 2-inch by 4-inch framing lumber, extending 4 inches on all sides beyond the limits of the installed equipment. Chamfer all corner edges of the pads all around by means of sheet metal or triangular wood strips nailed to the forms. Place foundation bolts in the forms before concrete is poured, after locating them correctly from templates. Allow 1-inch below equipment bases for alignment of the building where indicated. Construct foundations in accordance with approved shop drawings. Set equipment in place on concrete pads; level and align by means of shims prior to making service line connections, and apply grout. Use 3000 psi, 28-day compressive strength concrete.

B. Suspended equipment shall have supports consisting of manufactured metal framing or hangers conforming to Section 260529. Also provide engineered vibration isolators for suspended transformers.

C. Structural steel stands for support of equipment that is not floor mounted or suspended from overhead structure shall be constructed the same as specified in heavy duty pipe racks in Section 260529.

D. Where applicable, concrete foundation pads for outdoor switchgear and transformers shall conform to electrical utility specifications.

3.12 ELECTRICAL WIRING OF MOTORS, ALTERNATORS, AND EQUIPMENT

A. Except as otherwise specified in Division 21, 22, and 23, field wiring of motors and equipment shall be provided under Division 26.

B. See Divisions 21, 22 and 23 Sections for detailed requirements.

C. Conductor terminations to leads shall be properly insulated. Pre-engineered kits shall be used for large apparatus.
3.13 EQUIPMENT CONNECTIONS

A. Provide equipment furnished under Divisions 21, 22 and 23 and Divisions 26, 27, and 28, and Civil Engineering documents with necessary power, control, and communication wiring utility connections completed to allow safe and proper operation of the equipment.

B. Provide similar complete utility connections for equipment furnished under Divisions 1 through 20, inclusive, by the Owner, or under other contracts, using materials of similar quality to those used in making connections to similar Divisions 21, 22, 23, 26, 27 and 28 equipment with similar finishes.

C. Apply in writing to the Architect for any information needed to complete this work.

END OF SECTION
SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.
   3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.
   B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   B. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

1.7 SPECIAL WARRANTY

A. Heating Cable: Manufacturer agrees to repair or replace electric heating cable that fails within ten (10) years from date of substantial completion.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.
   B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN or XHHW.
   C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.
2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. Connectors: Make splices and connections in conductors using UL listed solderless pressure connectors. For all connections up to a maximum of one (1) No. 6 with two (2) No. 8 conductors, use Ideal “Wingnuts” of required sizes. Connections in conductors or combination of conductors larger than described above shall be made using Burndy cable fittings of the type and size required for the specific duty. After splice is securely “made-up”, entire assembly shall be insulated with UL listed insulating tape to a value equivalent to the adjacent insulation. Ground connections shall be made using Burndy ground clamps or connectors of a type suitable and UL listed for duty involved.

2.3 PLASTIC-INSULATED, SERIES-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Delta-Therm Corporation.
   2. Easy Heat Inc.
   3. NUHEAT.
   4. Orbit Manufacturing.
   5. Pyrotenax; a division of Tyco Thermal Controls.
   6. Raychem; a division of Tyco Thermal Controls.
   7. WarmlyYours.com Inc.
   8. Watts Radiant Inc.

B. Comply with IEEE 515.1.

C. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.

D. Electrical Insulating Jacket: Minimum 4.0-mil Kapton with silicone jacket or Tefzel.

E. Capacities and Characteristics:
   2. Piping Diameter: Refer to Specification Divisions 22 and 23.
   3. Number of Parallel Cables: 2
   4. Spiral Wrap Pitch: 3 inches.
   5. Verify available voltages and heat-output ratings with specified manufacturer.
   6. Volts: 120 V.
   7. Phase: 1 PH.
   8. Hertz: 60 Hz
   10. Minimum Circuit Ampacity: 30 A
   11. Maximum Overcurrent Protection: 30 A

F. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.

G. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

H. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

I. Corrosion-resistant, waterproof control enclosure.

J. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

K. Warning Labels: Refer to Division 23 Section “Identification for HVAC Piping and Equipment.”

L. Warning Tape: Continuously printed “Electrical Tracing”; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
   2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.
PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 INSTALLATION

A. Feeder and branch circuit conductors rated at 600 volt and below shall be sized to prevent voltage drop values exceeding the limits set forth in the NEC.

B. Care shall be exercised in handling and installing cables to avoid damage. Cables shall be carefully formed in equipment pull boxes and manholes. Bends in cables shall be larger than the minimum radii shown in the cable manufacturer's published data for minimum bends that will not reduce the cable life.

C. MC Cable
   1. MC cable is only allowed within partitions and millwork, where approved by owner in writing. The owner (UNT) gave written approval in the Retail project page turn set sent on 1/19/2021 in the notes based on the 1/15/2021 page turn meeting with the following requirements.
   2. If the contractor elects to use MC cable, the following requirements must be met:
      a. All MC cable must be properly supported per NEC requirements.
      b. Any segment of MC cable shall be no more than 10ft long, per UNT's written direction.
      c. MC cable shall only be used for final whips to equipment connections and individual light fixture whips, per UNT's written direction.
3.5 HEAT TRACE CABLES

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install electric heating cable across expansion joints according to manufacturer's written recommendations using slack cable to allow movement without damage to cable.

C. Install electric heating cables after piping has been tested and before insulation is installed.

D. Install electric heating cables according to IEEE 515.1.

E. Install insulation over piping with electric cables according to Division 23 Section "HVAC Insulation."

F. Install warning tape on piping insulation where piping is equipped with electric heating cables.

G. Set field-adjustable switches and circuit-breaker trip ranges.

H. Protect installed heating cables, including nonheating leads, from damage.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
   3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
      a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
      b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Remove and replace malfunctioning units and retest as specified above.

D. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

END OF SECTION
SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 inch by 4 inches in cross section, unless otherwise indicated on Drawings; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.
C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel (or stainless steel in highly corrosive soil); 5/8 inch by 10 feet in length.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
   1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
   2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install 3 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.
B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: For all Owner furnished equipment or where required by the utility company. Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.
   8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
   1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of area or item indicated.
   1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches from building foundation.

J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

K. Communications Grounding:
   1. Telephone: Provide one No. 2 "THW" to ground bus at each telephone equipment room; one No. 2 "THW" to telephone service conduits; and, one No.12 "THW" to conduits terminating at telephone backboards.
   2. Communications and Special Systems: Provide one No. 6 "THW" in 1/2-inch conduit from each system ground to nearest ground bus.
   3. Fire Alarm Systems: Provide one No.6 "THW" in 1/2-inch conduit from each system ground to nearest ground bus.
   4. Television Distribution Systems: Provide one No. 6 "THW" in 1/2-inch conduit from each system ground to nearest ground bus.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Test completed grounding system at each location where a maximum ground resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.
   3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
   2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
   3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
   4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

D. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

END OF SECTION
SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

B. Related Sections include the following:
   1. Division 26 Section "Vibration Controls For Electrical Systems" for products and installation requirements necessary for compliance.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.
1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   4. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
   1. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
   2. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
   3. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. Not approved for light weight concrete or slabs less than six (6) inches thick.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: Conduits or raceways may not be supported by openings through structure members.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
B. Related Sections include the following:
   1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS
A. EMT: Electrical metallic tubing.
B. ENT: Electrical nonmetallic tubing.
C. EPDM: Ethylene-propylene-diene terpolymer rubber.
D. FMC: Flexible metal conduit.
E. IMC: Intermediate metal conduit.
F. LFMC: Liquidtight flexible metal conduit.
G. LFNC: Liquidtight flexible nonmetallic conduit.
H. NBR: Acrylonitrile-butadiene rubber.
I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING
A. Rigid Steel Conduit: ANSI C80.1.
B. IMC: ANSI C80.6.
C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch, minimum.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   2. Fittings for EMT: Steel, compression type. No set screw fittings allowed per UNT design guidelines.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
   4. Fittings for RMC and IMC: Steel, threaded.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING


B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material. Provide watertight joints on all underground installations.

E. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type [1] [12] [3R], unless otherwise indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type unless noted otherwise on the drawings.

D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
2.5 BOXES, ENCLOSURES, AND CABINETS

A. Junction and pull boxes 100 cubic inches in volume and smaller shall be standard outlet boxes. Those larger than 100 cubic inches shall be constructed as specified for cabinet construction and shall be furnished with covers. Boxes shall be factory-fabricated from galvanized steel to prevent corrosion.

B. Size boxes in accordance with the requirements of the NEC. Boxes not used for service entrance duty shall be no smaller than 4 inches square and 1-1/2 inches deep with covers accessible at all times. Set boxes on concealed conduits with covers flush with the finished wall or ceiling line. Provide junction and pull boxes of appropriate dimensions for conduits and conductors noted, where shown and where necessary for the installation and pulling of cables and wires. Install covers on junction boxes and condulets after wiring and connections are completed.

C. At each outlet shown provide a box of suitable size and construction. Provide plaster rings, where required, in connection with adjacent plaster finishes. In unfinished masonry walls provide handy boxes of such size as to permit their being completely covered by the device plates. All boxes shall be galvanized steel. Unused knockouts in boxes shall be filled or capped before plates or devices are installed.

D. Ceiling outlets shall be 4-inch square boxes of the appropriate depth, furnished with 3/8-inch fixture studs fastened through from backs of the boxes. For plaster surfaces provide plaster rings and ears.

E. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Provide steel box mounting bracket for mounting to wood or steel studs per UNT Design Guide Appendix 32, Fig 32.

F. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

G. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

H. Nonmetallic Floor Boxes: Nonadjustable, round.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

K. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

L. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two. Not approved for areas subject to vehicle traffic.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame. Not approved for areas subject to vehicle traffic.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete or fiberglass.

2.7 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.8 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Stainless steel. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.9 FLOOR, CEILING AND WALL PLATES

A. In finished areas having ceilings, provide chrome plated, sectional escutcheons on exposed conduits and hanger rods penetrating walls, floors and ceilings.

B. Size escutcheons to fit snugly around conduits and rods and cover completely the openings through which the conduits and rods pass. Hold escutcheons firmly in place with clamps. No set screws allowed.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit RNC, Type EPC-80-PVC.
   2. Concealed Conduit, Aboveground: Rigid steel conduit RNC, Type EPC-40-PVC.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
   6. Application of Handholes and Boxes for Underground Wiring:
      a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete or fiberglass-reinforced polyester resin, SCTE 77, Tier 15 structural load rating.
      b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
      c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: PVC-coated rigid steel conduit.
7. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 36 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install metallic raceways as follows:
1. 3/4-Inch Trade Size: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set nonmetal floor boxes level and flush with finished floor surface.

Q. Set nonmetal floor boxes level. Trim after installation to fit flush with finished floor surface.

R. For systems over 600 volts:
1. Raceways for cable, provided under this Section, carrying more than 600 volts shall be standard, hot-dipped, rigid, galvanized, conduit. Raceways run underground other than under buildings or roadways, shall be non-metallic conduits encased in concrete.
2. Couplings, for non-metallic conduits, that are compatible with the raceway, shall be recommended and installed in accordance with manufacturer's instructions. Field cuts of non-metallic conduit shall be made with tools specifically recommended by and in accordance with the instructions of the raceway manufacturer.
3. Raceways run underground shall be run straight, with a minimum number of changes in direction. No changes in direction will be permitted due to improper ditching or support. Changes in direction shall be made only where indicated on the Drawings, and where specific approval is given. Offsets and bends up to 22.5 degrees may be made with non-metallic raceways. Bends greater than 22.5 degrees shall be made only with rigid steel conduit, and with each bend having a radius 12 feet or more. The total changes in direction in a single run (between manholes and pull boxes) shall not exceed 90 degrees. Bell ends shall be provided at conduit terminals in manholes, handholes and concrete pull boxes.
4. Connections from non-metallic conduit to rigid galvanized steel conduit shall be made with screw-on adapters.
5. Factory plugs shall be used to close all raceway ends immediately after the raceway installation. Suitable factory caps shall be installed on ends of runs during the construction period. Raceways with conductors shall be closed with sealing compound immediately after the conductors are in place.
6. Non-metallic conduit shall be held in place during placement with plastic base spacers, plastic intermediate spacers, and ties located not more than 5 feet apart to maintain raceway separation. Unless otherwise indicated, underground raceways under concrete paved areas shall be direct buried; in non-paved areas shall be separated by 2 inches of concrete and covered by not less than 3 inches of concrete on bottom, top and sides. The concrete encasement (non-reinforced) shall be on top of 3-inch sand fill placed in trench before raceways are installed. Banks of underground raceways shall be installed by the built-up method. Raceways shall be securely anchored together and held in place to avoid misalignment and floating during pouring of the concrete encasement.
7. Wherever underground raceways pass under buildings and roadways and for a distance of 5 feet from each building, and elsewhere as indicated, standard rigid galvanized steel conduit shall be...
used. This steel conduit shall also be concrete-encased and shall have insulating bushings wherever terminated.

8. Each conduit shall have a test mandrel of a diameter 1/4-inch less than, and a minimum length equal to, the nominal diameter of the conduit pulled through. This shall be rodded, if necessary. Immediately before the cable is pulled in each conduit, a wire brush and swab shall be pulled through the conduit. Immediately after a cable is pulled in, plug the conduit run ends with duct seal, or approved equal. Contractor shall install this "seal" on both power and communication cables, whether cable is installed by him or by others.

9. Concrete Encasement:
   a. Provide red-dyed concrete encasement affording not less than 3 inches cover for raceways containing conductors having a voltage of more than 600 volts.
   b. Concrete used for encasement of raceways shall be not less than 2500 pounds test at 28 days, and the maximum aggregate size shall not exceed 3/4-inch in diameter.
   c. Concrete encasement shall have a homogeneous red color, obtained as follows: Mix water, sand, gravel and Portland Cement same as for foundation concrete; then two (2) minutes before pouring, add not less than five (5) pounds of L. Sonneborn Sons, Inc. "Sonobrite Red" for each bag of Portland Cement in mixture, and continue mixing until thoroughly blended.
   d. Concrete encasement shall be poured and tamped carefully to prevent voids between, under, beside or on top of the ducts.
   e. Concrete encasement around "steel reinforced ductbanks" shall contain steel bars. Reinforcing bars shall be of the grade, type, and quality set forth for concrete walls in Division 3 of these Specifications. Unless indicated on the Drawings, each bank of ducts shall have one No. 4 bar in each of the four (4) corners of the bank with vertical and horizontal supports these bars consisting of No. 3 bars not more than 30-inches on centers along the duct bank run. Bars shall be located in the center of the 3-inch concrete cover for the raceways.
   f. The concrete encasement for the ductbank shall be dowelled into walls and grade beams where entering or passing through buildings. Dowels shall consist of No. 6 bars located not more than 8 inches on centers around the perimeter of the ductbank, and shall tie to both the wall and the ductbank steel.

S. For systems 600 volts and below:
   1. Underground conduits and conduits buried under concrete slabs on the ground shall be PVC conduit, or shall be rigid steel conduit having a protective wrapping. All stubups of PVC conduit runs shall be made with rigid galvanized steel conduit. (Provide corrosion protection where the conduit emerges from the concrete, from 3-inches below top of concrete to 3-inches above.)
   2. Metal conduits encased in concrete shall be galvanized rigid steel.
   3. Conduits exposed to the weather, and conduits above the roof of the building shall be galvanized rigid steel, having a corrosion-protective coating as specified above.
   4. Conduits shall be exposed in mechanical equipment rooms. Where exposed conduits are located at or within five feet (5') of the floor, they shall be galvanized rigid steel conduit or IMC. Other conduits on this project may be rigid, IMC, or EMT as permitted by code.
   5. Conduits shall be of such size and so installed that the conductors may be drawn through without injury or excessive strain, shall be secured at cabinets and boxes of all types, with galvanized locknuts, both inside and outside, and shall have appropriate bushings inside. Bushings may be of the insulating type or may be galvanized, unless bushings are used for grounding, in which case they shall be galvanized.
   6. Threaded conduits shall be reamed after threading, and shall be kept tightly closed at each end and in dry locations during construction. Conduits shall be swabbed out before the wires are pulled through.
   7. Conduit which is larger than 1 inch shall not be run horizontally within any floor slab, and where floor slab construction is no more than 2-1/2 inches thick no conduits shall be run horizontally within such concrete construction. Should it become necessary for a large number of conduits to be stubbed up at one location (for instance at a telephone terminal board or at a panelboard) such conduits shall be separated by at least 12 inches if run within the floor slab, and if this is not possible, conduits shall be extended into the attic space and then stubbed into the terminal location.
   8. Conduits piercing roofs shall be placed in position in time to be flashed.
   9. Final connections to motors shall be made with 12-inch or longer sections of flexible metal conduit. Flexible metal conduits shall also be employed to effect final connections to recessed lighting
fixtures. Flexible metal conduits in damp locations and in mechanical equipment rooms shall be neoprene-jacketed, UL listed watertight, complete with WP connections.

10. Metallic conduits shall be grounded in accordance with the requirements of the NEC.

11. Conduits shall not be installed within 3 inches of hot pipes except where crossings are unavoidable, in which case a clearance of 1 inch is permissible.

12. Provide junction, pull and splice boxes in conduit runs as required by the NEC and elsewhere as required to accommodate installation.

13. All conduits shall have a separate grounding conductor installed in accordance with NEC requirements.

14. Where overhead junction boxes are provided for future extension of wiring or to accommodate tenant needs, identify such boxes as “120-volt workstation clean”, “277-volt normal”, or “277-volt emergency”, etc. with circuit numbers, to facilitate identification and future extensions from the boxes.

15. Provide expansion couplings for all runs crossing building expansion joints. Provide expansion couplings for PVC conduit exposed and subject to temperature variations per Code.

16. Provide flexible liquidtight metallic conduit between all underground conduits stubbed up through slabs and terminations interior to building.

T. PVC telecommunications raceways underground shall be planned and installed with extreme care, especially under the building pad area. Contractor shall prepare large scale plan and profile drawings and pre-determine all bend lengths/radii prior to performing work.

U. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. Backfill shall consist of kiln dried grout sand from three inches below bottom surface of lowest conduit in duct bank to three inches above top surface of highest conduit in duct bank. Sand shall be agitated with vibrator to insure void spaces around conduit are filled. Cement stabilized sand in a flowable fill mixture may be used as an alternative to kiln dried sand. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.
6. Direct-bury conduits that are routed parallel to one another shall be supported with saddles and spacers to insure a minimum of 7.5 inches between conduit centerlines in any direction. For conduits larger than 4 inches in diameter, there shall be a minimum of 3 inches separation from outside wall to outside wall in any direction.
7. Parallel direct-bury conduits shall be evenly spaced and shall maintain spacing through the entire length of the conduits.

3.3 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES
A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer’s written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
SECTION 260548 - VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:
   1. Isolation pads.

B. Related Sections include the following:
   1. Division 26 Section "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS


C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation required to select vibration isolators.
   2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
   3. Field-fabricated supports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in the specifications or a comparable product by one of the following:
   1. Amber/Booth Company, Inc.
   2. Mason Industries.
   3. Vibration Eliminator Co., Inc.
B. Pads: Arrange in two 3/8” layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
   1. Resilient Material: Oil- and water-resistant neoprene
   2. Peabody Type NGDD, Mason Type WSW, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application.

B. Provide vibration isolation pads beneath all transformers, uninterruptible power supplies and indoor generator sets.

END OF SECTION
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. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE


B. Comply with NFPA 70.


D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS

2.1 POWER RACEWAY AND CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 FLOOR MARKING TAPE

A. 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,

C. Type:
   1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   2. Thickness: 4 mils.
   3. Weight: 18.5 lb/1000 sq. ft.
   4. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

2.5 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive or punched for screw mounting, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
   1. Label all service disconnects.
   2. Labels shall include voltage, circuit fed by, and name of device.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend “DANGER CONCEALED HIGH VOLTAGE WIRING” with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
   1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
   2. Wall surfaces directly external to raceways concealed within wall.
   3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl or Snap- around labels. Install labels at 10-foot maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, and Feeder: Identify with selfadhesive vinyl label. Install labels at 30-foot maximum intervals.

D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   2. Power.

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral: White
         5) Ground: Green
      c. Colors for 480/277-V Circuits:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral: White
         5) Ground: Gray/Green
      d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.

M. Circuit labels for outlet boxes: All 208/277/480V circuits shall be identified at each junction box it passes through, on the inside of the junction box cover per UNT Design Guidelines. All 120V outlet covers shall be labeled with the panel and circuit breaker number it is fed from.

N. Arc-Flash & Shock-Hazard Warning Labels
   1. Install arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels, and other electrical equipment that is likely to require examination, adjustment, servicing, or maintenance while energized.
   2. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
   3. On renovation projects, install arc-flash warning labels on existing equipment where lock-out/tag-out will be required for the renovation work.
   4. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.
      a. Arc-Flash Protection Boundary
      b. Arc-flash incident energy calculated in accordance with IEEE Std 1584a™
      c. Working distance calculated in accordance with IEEE Std 1584a™
      d. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
      e. System phase-to-phase voltage
      f. Condition(s) when a shock hazard exists (e.g. “With cover off”)
      g. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
      h. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
      i. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
      j. Unique equipment designation or code (described under “Component Identification” below)
k. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
l. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
m. Date that the hazard analysis was performed.
n. “Served from” circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
o. If applicable, the “serves” circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.

5. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a™, paragraph 9.3.2.

6. Use a “DANGER” label where the calculated arc-flash incident energy exceeds 40 cal/cm.

O. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

P. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.

Q. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Self-adhesive or drilled for screw mounting, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchgear.
   e. Switchboards.
   f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   g. Substations.
   h. Emergency system boxes and enclosures.
   i. Motor-control centers.
   j. Enclosed switches.
   k. Enclosed circuit breakers.
   l. Enclosed controllers.
   m. Variable-speed controllers.
   n. Push-button stations.
   o. Power transfer equipment.
   p. Contactors.
   q. Remote-controlled switches, dimmer modules, and control devices.
   r. Power-generating units.
   s. Monitoring and control equipment.
3.3 DOCUMENTATION

A. Provide a typewritten chart, framed under glass, to correlate identification, abbreviations, equipment numbers, color schemes, and similar information.

B. Provide an overall 1-line power distribution drawing, multi-colored, of the entire electrical distribution system, framed under glass and mounted in each building’s main electrical room where directed. Contact architect for color scheme.

END OF SECTION
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SECTION 260923 - LIGHTING CONTROL DEVICES

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. This Section includes the following lighting control devices:
   1. Time switches.
   2. Outdoor photoelectric switches.
   3. Indoor occupancy sensors.
   4. Lighting contactors.

B. Related Sections include the following:
   1. Division 26 Sections "Modular Dimming Controls" for architectural dimming system equipment.
   2. Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.
   3. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Operation and Maintenance Data: For each type of lighting control device.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
   1. Contact Configuration: DPST.
   2. Contact Rating: 30-A inductive or resistive, 240-V ac, 20-A ballast load, 120/240-V ac.
   3. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
   4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
   1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
   2. Time Delay: 30-second minimum, to prevent false operation.

2.3 INDOOR OCCUPANCY SENSORS

A. Provide products by the following manufacturer:

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
   1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
   1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
   1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
   2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
   4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
   5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.
E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

F. Refer to Section 262726 for integral wall-mounted sensor/switches.

2.4 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. GE Industrial Systems; Total Lighting Control.
2. Square D; Schneider Electric.

B. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as scheduled, but at a minimum provide auxiliary contacts, HOA switch, and pilot lights. Control devices shall match the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
2. Control: On-off operation.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors properly sized to meet NEC requirements. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors properly sized to meet NEC requirements. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer’s written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.
3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section “Low-Voltage Electrical Power Conductors and Cables.” Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer’s written instructions.

C. Size conductors according to lighting control device manufacturer’s written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section “Identification for Electrical Systems.”
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
   2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

C. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.6 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section “Network Lighting Controls.”

B. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section “Demonstration and Training.”

END OF SECTION
SECTION 260936 - MODULAR DIMMING CONTROLS

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. This Section includes the following:
   2. Integrated, multipreset modular dimming controls.

1.3 DEFINITIONS

A. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

C. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.

D. SCR: Silicon-controlled rectifier.

E. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
   2. Device plates and plate color and material.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions. Include coordination with the following:
   1. Division 26 Section “Lighting Control Devices.”
PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.

B. Dimmers and Dimmer Modules: Comply with UL 508.
   1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
   2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.2 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
   2. Lightolier Controls; a division of Lightolier; a Genlyte Group.
   3. Lutron Electronics, Inc.

B. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.

C. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.

D. Each manual modular multiscene dimming controller shall include a master control and remote controls.

E. Each zone shall be configurable to control the following:
   1. Fluorescent lamps with electronic ballasts.
   2. Incandescent lamps.
   3. Low-voltage incandescent lamps.
   4. LED sources and electronic drivers.

F. Memory: Retain preset scenes through power failures for at least seven days.

G. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices."

H. Master-Scene Controller: Suitable for mounting in a single flush wall box.
   1. Switches: Master off, group dim, group bright, and selectors for each scene.
   2. LED indicator lights, one associated with each scene switch, and one for the master off switch.

I. Fluorescent/LED Zone Dimmer: Suitable for operating lighting fixtures and ballasts/drivers specified in Division 26 Section "Interior Lighting," and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
   1. Switch: Rocker style for setting the light level for each scene.
   2. LED indicator lights, one associated with each scene.
   3. Electrical Rating: 2000 VA, 120 V.

J. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
1. Switch: Rocker style for setting the light level for each scene.
2. LED indicator lights, one associated with each scene.
3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

2.3 INTEGRATED, MULTIPRESET MODULAR DIMMING CONTROLS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
2. Lightolier Controls; a division of Lightolier; a Genlyte Group.
3. Lutron Electronics, Inc.

B. Indicate number of wall-box, remote-control stations.

C. Description: Factory-fabricated, microprocessor-based, solid-state controls providing manual dimming control consisting of a master station and multiple wall-box, remote-control stations.

D. Operation: Automatically changes variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.

E. Each zone shall be configurable to control the following:
1. Fluorescent lamps with electronic ballasts.
2. Incandescent lamps.
3. Low-voltage incandescent lamps.
4. LED sources and electronic drivers.

F. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.

G. Master Station:
1. Contains control panel and multiple control and dimmer modules.
2. Controls and commands adjustment of each dimmer-zone setting for each scene change from one preset scene to another.
   a. Master zone raises and lowers lighting level.
   b. Adjustable fade rate for each scene from 1 to 60 seconds.
3. Rear-illuminated, scene-select buttons.
4. Lighting-level setting and fade-rate setting shall be graphically shown using LEDs or backlighted bar-graph indicator.

H. Remote-Control Stations:
1. Numbered push buttons to select scenes.
2. Off switch to turn master station off.
3. On switch turns all scenes of master station to full bright.

I. Infrared Remote-Control Station: Same functions as for standard remote-control station, except that functions are input by a hand-held infrared transmitter.

J. Dimmers: Modular, plug-in type, with circuit breaker to protect the dimmer and branch circuit.
1. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
2. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
3. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
4. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.
5. Short-Circuit Rating: 10 kA for 120 V and 14 kA for 277 V.
2.4 CONDUCTORS AND CABLES

A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors properly sized to meet NEC requirements. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identifying components and power and control wiring.

B. Label each dimmer module with a unique designation.

C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Continuity tests of circuits.
   2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
      a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

C. Remove and replace malfunctioning modular dimming control components and retest as specified above.

D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
F. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls. After this training is complete, the owner's maintenance personnel shall be able to fully adjust the controls without contacting the factory-authorized representative and occurring site visit fees.

B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

END OF SECTION
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SECTION 260943 - NETWORK LIGHTING CONTROLS

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. This Section includes manually operated, PC-based, digital lighting controls with relays and control module.

B. Related Sections include the following:
   1. Division 26 Section "Lighting Control Devices" for time switches, photoelectric switches, occupancy sensors, and multipole contactors.
   2. Division 26 Section "Modular Dimming Controls" for dimming control components.

1.3 DEFINITIONS

A. BACnet: A networking communication protocol that complies with ASHRAE 135.

B. BAS: Building automation system.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

F. PC: Personal computer; sometimes plural as "PCs."

G. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

H. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.4 SUBMITTALS

A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.

B. Shop Drawings: Narrative sequence of operations, detail assemblies of standard components, custom assembled for specific application on this Project.
   1. Most important - Narrative Description: Written description outlining the summary of the sequence of operations for each space type.
      a. Example: Room number XXX: This open dining area has 5 dimming zones of control. The all the zones automatically come ON each day to 85%, 1 hour before the dining hall opens and OFF 30 minutes after the dining hall closes. These settings can be manually overridden to OFF or to a different dimming setting via wall switches during the day. During the off-hours the lighting is manual ON via wall switches and automatic OFF via vacancy sensors after 20 minutes of no activity. The emergency lighting in the room is controlled with the normal lighting during normal operations.
2. **Outline Drawings:** Indicate dimensions, weights, arrangement of components, and clearance and access requirements that meet the narrative description.

3. **Block Diagram:** Show interconnections between components specified in this section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

4. **Wiring Diagrams:** Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

### 1.5 QUALITY ASSURANCE

A. **Source Limitations:** Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with protocol described in IEC 60929, Annex E, for DALI lighting control devices, wiring, and computer hardware and software.

E. Comply with NFPA 70.

### 1.6 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.

2. Coordinate lighting controls with BAS. Design display graphics showing building areas controlled; include the status of lighting controls in each area.

3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

B. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards."

### 1.7 WARRANTY

A. **Special Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of software input/output to execute switching or dimming commands.
   b. Failure of modular relays to operate under manual or software commands.
   c. Damage of electronic components due to transient voltage surges.

2. **Warranty Period:** Two years from date of Substantial Completion.

3. **Extended Warranty Period Failure Due to Transient Voltage Surges:** Eight years.

4. **Extended Warranty Period for Electrically Held Relays:** 10 years from date of Substantial Completion.

### 1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. **Electrically Held Relays:** Equal to 10 percent of amount installed for each size indicated, but no fewer than 10 relays.

### 1.9 SOFTWARE SERVICE AGREEMENT

A. **Technical Support:** Beginning with Substantial Completion, provide software support for two years.
B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
   1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment, if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Acuity Brands, matching the rest of the existing dining hall’s lighting controls.

2.2 SYSTEM REQUIREMENTS

A. System shall be a complete modular low-voltage switching platform for use as a networked system with an internal microprocessor based building management interface module. System shall accept building automation system input for ON/OFF scheduled control and ON/OFF manual control shall be provided via low voltage data line switches, low voltage momentary switches and photocontrol. During “occupied” hours, system shall accept ON input from building automation system but shall be capable of being overridden to the OFF state per zone by manual controls. During “unoccupied” hours, system shall accept OFF input from building automation system but shall be capable of being overridden to the ON state per zone by manual controls for a period of two hours (adjustable.) Five (5) minutes prior to the system override expiration, the lighting control system shall blink the zone of lights that have been overridden twice to notify occupant the override period is expiring.

B. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

C. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.3 CONTROL MODULE

A. Control Module Description: Comply with UL 508 (CSA C22.2, No. 14); microprocessor-based, programmable, control unit; mounted in preassembled, modular relay panel. Low-voltage-controlled, latching-type, single-pole lighting circuit relays shall be prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays. Control units shall be capable of receiving inputs from sensors and other sources. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable.

B. Automation - Network Clock:
   1. Network Clock can be used to schedule any of the 8 global channel groups in the relay panel network.
   2. Network shall include user-selectable intelligent scenarios to handle standard lighting control functions for each channel independently, including:
      a. Schedule ON / Schedule OFF
      b. Manual ON / Schedule OFF
      c. Astronomical ON / Astronomical OFF (with user selectable offsets)
      d. Astronomical ON / Schedule OFF (with user selectable offsets)
      e. Manual ON / Multiple OFF Sweeps using Automatic Control Switch
   3. Network Clock shall automatically detect the presence of a dataline Photocontrol Module and alter the Astronomical scenarios to Dark, accepting actual light level readings for the following scenarios:
      a. Dark ON / Dark OFF
      b. Dark ON / Schedule OFF
4. Each channel can be assigned a standard time delay from 1-240 minutes (4 hours). During Occupied hours, the time delays do not take effect. During Unoccupied hours, the time delays will ensure that overridden lights are automatically turned off.

5. Each channel can be assigned an automatic blinking of the lights before they are turned off to allow occupants the opportunity to enter an override without being put in the dark.

6. Network Clock shall include system diagnostic functions to identify devices anywhere on the network dataline.

7. Clear 8-line, 22-character per line display and a simple user interface.

8. Takes into account leap year, daylight savings time, and holidays.

9. Provides system diagnostics for all components connected to the system.

10. Allows the user to plug into each dataline switch, run diagnostics, and reprogram the switch to any relay or channel.

11. Retains memory and time for a minimum of 10 years.

12. The BMS Interface Module shall allow an external automation device to provide the signal that changes channel status from Occupied to Unoccupied (after-hours).

13. The BMS Interface Module shall include system diagnostic functions to identify devices anywhere on the network dataline.

2.4 POWER DISTRIBUTION COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.
   a. Barriers separate low-voltage and line-voltage components.
   b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
   c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
   a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
   c. Endurance: 50,000 cycles at rated capacity.

3. Mounting: Provision for easy removal and installation in relay cabinet. Channels: Eight channels for grouping relays shall be provided in each interior regardless of size, each with a terminal block for a separate dry contact input. Any number of relays in the panel can be assigned to each channel, with overlapping allowed. Channels shall be set up without hand held programmer or keypads. Systems that require programmers or keypads, or that change relay states during set up, are not acceptable.

4. Power Supply: Two separate 40 VA transformers in one power supply assembly shall be provided. Systems requiring a separate pilot light transformer circuit will not be acceptable. Transformers include internal overcurrent protection with automatic reset and metal oxide varistor protection against power line spikes.

5. Network Dataline
   a. The intelligence in multiple panels shall be linked over a single dataline that uses the open Echelon/LonTalk® protocol for communications. The dataline shall not require any ancillary equipment to function properly.
   b. The dataline, in addition to linking together multiple relay panels, shall be capable of providing a single communications bus to allow dataline switches to communicate with the panels.
   c. Dataline shall be 18 AWG, 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements and shall be routed in conduit. The dataline can be run in a loop, serial, or star configuration.
   d. Maximum length for all dataline wire in the system is 1,500 feet without repeaters.
   e. Maximum number of dataline devices is 64 without a repeater.

2.5 MANUAL SWITCHES AND PLATES

A. Push-Button Switches: Modular, momentary-contact, low-voltage type.
1. Match color specified in Division 26 Section "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.
3. Internal white LED locator light to illuminate when circuit is off.

B. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Division 26 Section "Wiring Devices."

C. Wall-Box Dimmers: Comply with Division 26 Section "Wiring Devices."

D. Wall Plates: Single and multigang plates as specified in Division 26 Section "Wiring Devices."

E. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors of an AWG recommended by the manufacturer, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors of an AWG recommended by the manufacturer, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e or 6, as recommended by the manufacturer, for horizontal copper cable and with Division 27 Section "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

G. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 COORDINATION WITH DRAWINGS

A. Refer to the project drawings for additional requirements related to network lighting controls.
3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing. This must be completed prior to the engineer’s final punch walk.

B. Perform the following field tests and inspections and prepare test reports, prior to the engineer’s final punch walk:
1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components selected by Architect.

C. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect or engineer as needed.

3.4 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain lighting controls and software training for PC-based control systems. Refer to Division 01 Section “Demonstration and Training.” This must be done prior to the engineer’s final punch walk.

END OF SECTION
SECTION 262726 - WIRING DEVICES

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. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Receptacles with integral surge suppression units.
   5. Isolated-ground receptacles.
   6. USB charger receptacles
   7. Snap switches and wall-box dimmers.
   8. Solid-state fan speed controls.
   11. Cord and plug sets.
   12. Floor boxes, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.
E. TVSS: Transient voltage surge suppressor.
F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers’ Names: Shortened versions (shown in parentheses) of the following manufacturers’ names are used in other Part 2 articles:
   1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Legrand/Pass & Seymour; Wiring Devices & Accessories (Pass & Seymour).
   4. Arrow-Hart: Cooper Industries

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, WC596 and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; HBL5351 (single), CR5352 (duplex).
      b. Leviton; 5891 (single), 5352 (duplex).
      c. Pass & Seymour; 5361 (single), CRB5362 (duplex).
      d. Arrow-Hart; 5351 (single), 5362 (duplex)

B. Plug load half-controlled receptacles, 125 V, 20A: Receptacle should be permanently marked with the universally recognized power symbol shown in NEC 2014 figure 406.3(E). Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, WC596 and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Leviton; 5352-1PW
      b. Pass & Seymour; 5362CH
      c. Hubbell BR20C1

C. Plug load full-controlled receptacles, 125 V, 20A: Receptacle should be permanently marked with the universally recognized power symbol shown in NEC 2014 figure 406.3(E). Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, WC596 and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Leviton; 5352-2PW
      b. Pass & Seymour; 5362CD
      c. Hubbell BR20C2

D. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, WC596 and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; CR 5253IG.
      b. Leviton; 5362-IG.
      c. Pass & Seymour; IG5362.
      d. Arrow-Hart; IG5362RN
   2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

E. USB Charger Receptacles, 125V, 20A: Comply with NEMA WD6 configuration 5-20R, WC596 and UL498 and UL1310. Dual USB outlets required with a minimum of 3.1A, 5VDC.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; USB20X2W
      b. Leviton; T832
      c. Pass & Seymour; TR5362USB
      d. Arrow-Hart; TR7756
F. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, WC596 and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; HBL8300SG.
   b. Leviton; MT5632
   c. Pass & Seymour; TR5362.
   d. Arrow-Hart; TR5362
2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPMTALES
A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, WC596, UL 498, and UL 943, Class A, and include indicator light that designates when device is tripped. Must have self-test feature (conducts and automatic test every three seconds) ensuring ground fault protection. If ground fault protection is compromised power to the receptacle must be discontinued.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A, WC596:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell GFRST20
      b. Leviton GFNT2-W
      c. Pass & Seymour; 2097.
      d. Arrow-Hart; SGF20

C. Blank Face GFCI devices, 125V, 20A: Faceless GFCI device intended to protect downstream receptacles; Leviton 7590, or equal.

2.4 TVSS RECEPMTALES
A. General Description: Comply with NEMA WD 1, NEMA WD 6, WC596, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
   1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
   2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; HBL5362SA.
      b. Leviton; 5380.
      c. Pass & Seymour; 5362WSP
      d. Arrow-Hart; 5350__S
   2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

C. Isolated-Ground, TVSS, Duplex Convenience Receptacles:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; IG5362SA.
      b. Leviton; 5380-IG.
      c. Pass & Seymour; IG5362WSP
      d. Arrow-Hart; IG5350__S
   2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 TWIST-LOCKING RECEPMTALES
A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; HBL2310.
   b. Leviton; 2310.
   c. Pass & Seymour; L520-R.
   d. Arrow-Hart; CWL520R

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; IG2310.
      b. Leviton; 2310-IG.
      c. Pass & Seymour; IGL520R
      d. Arrow-Hart; IGL520R
   2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
   2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.

2.8 SNAP SWITCHES

A. Comply with NEMA WD 1, WC-896 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
      b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      c. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).
      d. Arrow-Hart; AH1221 (single pole), AH1222 (two pole), AH1223 (three way), AH1224 (four way)

C. Pilot Light Switches, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; HBL1221PL for 120 V and 277 V.
      b. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
      c. Pass & Seymour; PS20AC1-RPL for 120 V, PS20AC1-RPL7 for 277V.
      d. Arrow-Hart; AH1221PL for 120 V and 277 V.
   2. Description: Single pole, with neon-lighted handle, illuminated when switch is “ON.”

D. Key-Operated Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; HBL1221L.
      b. Leviton; 1221-2L.
      c. Pass & Seymour; PS20AC1-L.
d. Arrow-Hart; AH1221L

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; HBL1557.
   b. Leviton; 1257.
   c. Pass & Seymour; 1251.
   d. Arrow-Hart; 1995B

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 1995L.
   b. Hubbell; HBL1557L.
   c. Leviton; 1257L.
   d. Pass & Seymour; 1251L.

2.9 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
1. 600 W; dimmers shall require no derating when ganged with other devices.

D. Fluorescent and LED Lamp Dimmer Switches: Modular; compatible with dimming ballasts or drivers; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

E. Dimmers shall be Leviton "Monet", Lutron "Nova Star", or Pass & Seymour "Titan".

2.10 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
1. Continuously adjustable rotary knob, 5A.
2. Three-speed adjustable rotary knob, 1.5 A.

2.11 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; WS1277.
   b. Leviton; ODS 10-1D.
   c. Pass & Seymour; WSP250.
   d. Watt Stopper (The); WS301.
   e. Arrow-Hart; 6119V
2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
3. Provide single or dual level control as indicated on the drawings.

B. Long-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
a. Hubbell; ATP1600WRP.
b. Leviton; ODWWV-IRW.
c. Pass & Seymour; HS1001.
d. Watt Stopper (The); CX-100.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..

C. Wide-Range Wall-Switch Sensors:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hubbell; ATP120HBRP.
      b. Leviton; ODWHB-IRW.
      c. Pass & Seymour; WA1001.
      d. Watt Stopper (The); CX-100-3.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.

2.12 WALL PLATES
A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic, except provide 0.035-inch- thick, satin-finished stainless steel in all food servicing areas.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with metal in use lockable cover.

2.13 FLOOR BOXES
A. Standard Floor Box: Floor box shall be two-gang with removable dividers. Each single-gang shall accommodate a duplex receptacle or two communication services. Unit shall be adjustable before and after pour. For on-grade application, floor box shall be cast iron. For above grade application, unit shall be stamped steel. Box shall have standard conduit tapping of ¾" and a maximum conduit tapping of 1-1/4". Overplates shall be per Architect - Steel City 640/740 series or equal.

B. Four (4) Device Combination Box: Floor Box shall have four independent wiring compartments. Each compartment shall be able to accommodate a duplex receptacle or four communication services. Unit shall be fully adjustable before and after pour. For above grade application, floor box shall be stamped steel. Activation compartment shall be flushed, recessed with carpet flange, hinged access plate, and retractable exit. Provide mounting brackets, plates, wiring, and devices as indicated on the Drawings. Walker RFB4 or approved equal.

C. High Capacity Combination Floor Box: Floor box shall have minimum six (6) wiring compartments. Each compartment shall be able to accommodate a duplex receptacle or two communication services. Unit shall be fully adjustable before and after pour. For on-grade application, floor box shall be cast iron (stamped steel with vapor barrier is not acceptable). For above grade application, floor box shall be stamped steel. Activation compartment shall be flushed, recessed with carpet flange, hinged access plate and retractable exit. Provide mounting brackets, plates and wiring devices as indicated on the Drawings. Hubbell LCFB or equal.

Refer to drawings for detailed description of floor boxes and architectural/structural conditions.

2.14 POKE-THROUGH ASSEMBLIES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
3. Wiremold Company (The).

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
   1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
   2. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
   3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   4. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
   5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.
   6. Standard poke-through device shall be Wiremold/Walker RC4 or equal.
   7. Standard poke-through furniture feed shall be Wiremold/Walker RC900-AM or equal.

2.15 MULTIOUMLT ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold Company (The).

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: [Metal, with manufacturer's standard finish] [PVC].

D. Wire: No. 12 AWG.

2.16 SERVICE POLES

A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
   1. Poles: Nominal 2.5-inch- square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
   2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
   3. Finishes: Manufacturer's standard painted finish and trim combination.
   4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
   5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.

2.17 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color. Provide wiring devices and wall plates in colors selected by the architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailling existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Modular devices are permitted for use. Modular connectors shall be UL listed and contain crimped and welded brass connections. Modular receptacles shall be listed to UL498 and WC-596G. Modular switches shall be listed to UL20 and WC-896.
7. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
9. Tighten unused terminal screws on the device.
10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

J. Wall switches, unless noted otherwise, shall be mounted 48" above finished floor.

K. Receptacles shall be mounted per A.D.A. height, above finished floor, except where heights are specifically called out on the Drawings. Receptacles above countertops in toilet rooms, dressing rooms, reception areas, and food service areas shall be mounted 6 inches (to center) above countertops or backsplashes, if not indicated otherwise on architectural details.

L. Where signal, communications, data and control outlets are indicated adjacent to 115 volt or 230 volt convenience outlets, mount these outlets in a symmetrical pattern.
M. If the outlets are normally mounted adjacent to each other throughout this project, they shall be mounted on 10 inch centers with the tops of the boxes at the same elevation. If one outlet is mounted adjacent to the floor, and the second outlet mounted adjacent to the ceiling, these outlets shall be lined up vertically whether so shown or not, in order to form a symmetrical pattern on the wall.

N. Use blank face GFCI devices where the required location of receptacle will not allow proper access for testing and operation. Install blank face GFCI device to meet accessibility standards.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."
   1. Receptacles: Identify panelboard and circuit number from which served. Use hot stamped or engraved machine writing with black lettering attached to inside of outlet box.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
   2. Test Instruments: Use instruments that comply with UL 1436.
   3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

END OF SECTION
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SECTION 262813 - FUSES

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. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers and motor-control centers.
   2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
   1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
      a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
      b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
   2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
   5. Coordination charts and tables and related data.
   6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.
1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Bussmann, Inc.
   2. Edison Fuse, Inc.
   3. Mersen.
   4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
   2. Finish: Gray, baked enamel.
   3. Identification: "SPARE FUSES" in 1-1/2-inch high letters on exterior of door.
   4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

1. Refer to schedules on drawings for descriptions of fuses in each application.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION
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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers’ technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. If a local disconnecting means is installed on the secondary side of the VFD, then an auxiliary contact inside the disconnecting means shall be wired back to the VFD safety shutdown circuit that shall shut down the VFD. This control wiring shall be in a separate conduit from the motor power feed.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.


D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I²t response.
E. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

F. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with ground-fault trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.
E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

E. Compile and maintain all field quality control reports and make available to the AHJ, owner, architect and engineer as needed.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION
SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

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. This section includes lightning protection for buildings.

B. The existing building has an existing lightning protection system already installed and certified by Hicks lighting protection, 7420 FM 2449 Ponder, TX 76259; PH. (940) 479-2114, shop drawings dated 10/19/18.

C. The scope of the UNT Dining Hall Retail project is adding mechanical and food service equipment on the roof. The Lightning Protection contractor for this Retail project shall modify the existing system to include this new roof mounted equipment as required, and the entire system shall be re-certified per this specification’s requirements.

1.3 DEFINITIONS

A. LPI: Lightning Protection Institute.

B. NRTL: National recognized testing laboratory.

1.4 SUBMITTALS

A. Product Data: For air terminals and mounting accessories.

B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

C. Final report of required testing.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications: Contractor shall have personnel on staff that are certified by LPI as a Master Installer/Designer.

B. Installers: Journeyman or higher personnel shall provide on-site supervision of the installation.

C. Listing and Labeling: As defined in NFPA 780, “Definitions” Article.

1.6 PERFORMANCE

A. Contractor shall design a complete lightning protection system including all components described in Part 2 below.
1.7 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Approved Lightning Protection Co., Inc.
   2. Independent Protection Co.
   3. Thompson Lightning Protection, Inc.
   4. Robbins Lightning, Inc.
   5. Bonded Lightning Protection Systems, Ltd.
   6. VFC Inc.
   7. Erico Products Inc.
   8. Harger, Inc.
   9. Lyncole.
   10. East Coast Lightning Protection, Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. All materials shall comply in weight, size, and composition with the requirements of the UL 96 Materials Standards. All equipment shall be UL listed and properly labeled. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment and a member of LPI. Equipment shall be the manufacturer’s latest approved design of construction to suit the application where it is to be used in accordance with accepted industry standards and with NFPA, LPI, & UL requirements. Comply with UL 96.

B. XIT Grounding System
   1. A Lyncole XIT Grounding System shall be installed at Electrical Service Entrance. Either a vertical or horizontal 10’ unit shall be used. Lyncole part numbers K2-10CSD, or K2L-10CSD.
   2. A Main Ground bar shall be installed at the electrical service with minimum dimensions of ¼” x 4” x 24” with 2 hole lug spacing.

C. Lightning Protection
   1. Class I materials shall be used for systems on structures not exceeding 75 feet in height and Class II materials shall be used for systems on structures exceeding 75 feet above grade.
   2. Copper shall be of the grade ordinarily required for commercial electrical work, generally designated as being 95 percent conductive when annealed.
   3. Lightning protection materials shall be coordinated with building construction materials to assure compatibility. Aluminum lightning protection materials shall not be embedded in concrete or masonry, installed on or below copper surfaces, or used for the in-ground system. Copper lightning protection materials shall not be installed on aluminum surfaces or on exterior sheet metal surfaces. Copper system components within 2 feet of chimney exhausts shall be tin coated to protect against deterioration.
   4. Strike termination devices shall be provided to place the entire structure under a zone of protection as defined by the Standards. Air terminals shall project a minimum of 10 inches above protected areas or objects. Air terminals shall be located within 2 feet of exposed corners and roof edges.
   5. Metallic bodies having a thickness 3/16” or greater may serve as strike termination devices without the addition of air terminals. These bodies shall be made a part of the lightning protection system by connection(s) according to the Standards using main size conductors and bonding fittings with 3 square inches of surface contact area.
   6. Cable conductors shall provide a two-way path from strike termination devices horizontally and downward to connections with the ground system. Cable conductors shall be free of excessive splices and sharp bends. No bend of a conductor shall form a final included angle of less than 90
degrees or have a radius of bend less than 8 inches. Structural elements and design features shall be used whenever possible to minimize the visual impact of exposed conductors.

7. Cable down conductors may be concealed within the building construction or enclosed within PVC conduit from roof to grade level. Down conductors shall be spaced at intervals averaging not more than 100 feet around the protected perimeter of the structure. In no case shall any structure have fewer than two down conductors. Where down conductors are exposed to environmental hazards at grade level, guards shall be used to protect the conductor to a point 6 feet above grade.

8. In the case of structural steel frame construction, cable down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals averaging not more than 100 feet around the protected perimeter of the structure.

9. Exposed cable conductors shall be secured to the structure at intervals not exceeding 3 feet – 0 inches.

10. All fasteners to be VFC Z-Pen #ZP3412 with appropriate loop supports. No support penetrations shall be made in any sheet metal flashing or roof top equipment. Sheet metal screws shall not be used. Appropriate adhesive supports and construction mastic may be used on Membrane roof surfaces only. Adhesive supports and construction mastic shall not be used on any sheet metal surfaces.

11. Connectors and splicers shall be of suitable configuration and type for the intended application and of the same material as the conductors or of electrolytically compatible materials.

12. Ground terminations suitable for the soil conditions shall be provided for each downlead conductor. Where the structural steel framework is utilized as main conductors for the system, perimeter columns shall be connected to the grounding system at intervals averaging 60 feet or less on the protected perimeter. For any structure in excess of 60 ft. in vertical elevation above grade, a ground loop interconnecting all ground terminals and other building grounded systems shall be provided.

13. Common interconnection of all grounded systems within the building shall be accomplished using main size conductors and fittings. Grounded metal bodies located within the calculated bonding distance as determined by the formulas of the Standards shall be bonded to the system using properly sized bonding conductors.

D. Roof-Mounting Air Terminals: NFPA Class I or 2, as applicable, copper, solid tubular, unless otherwise indicated.

E. Stack-Mounting Air Terminals: Solid copper

F. Provide bronze cable connections and splices.

G. Ground Rods, Ground Loop Conductors, and Concrete-Encased Electrodes: Comply with Division 26 Section "Grounding and Bonding for Electrical Systems" and with standards referenced in this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to LPI 175, UL 96A and NFPA 780. Comply with manufacturer’s installation instructions.

B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

C. Conceal the following conductors:
   1. System conductors.
   2. Down conductors.
   3. Interior conductors.
   4. Conductors within normal view from exterior locations at grade within 200 feet of building.
   5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.

D. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.
E. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer’s written instructions.

F. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.

G. A counterpoise installation based on requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" may be used as a ground loop required by NFPA 780, provided counterpoise conductor meets or exceeds minimum requirements in NFPA 780.
   1. Bond ground terminals to counterpoise conductor.
   2. Bond grounded metal bodies on building within 12 feet of ground to counterpoise conductor.
   3. Bond grounded metal bodies on building within 12 feet of roof to interconnecting loop at eave level or above.

H. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot intervals.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 FIELD QUALITY CONTROL

A. UL Inspection: Provide inspections as required to obtain a UL Master Label for system.

B. Provide an inspection by an inspector certified by LPI to obtain an LPI certification.

3.4 TESTING

A. Upon completion of installation of lightning protection system, test resistance-to-ground (earthing connection) with resistance tester. Where tests indicate resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms or less, by driving additional, properly spaced rods, and treating soil in proximity to ground rods with common salt, copper sulfate or magnesium sulfate. Then retest to demonstrate compliance.

3.5 FINAL REPORT

A. Submit a final report, based on industry standards, that includes the following:
   1. As-Built drawings stamped by an LPI or NRTL certified master designer.
   2. Final systems to ground resistance level.
   3. Testing of the internal bonding and grounding systems.
   4. Testing of the equipment grounding.
   5. Copy of the LIP certification.

3.6 PERSONNEL TRAINING

A. Building Maintenance Personnel Training: Train Owner’s building maintenance personnel in procedures for testing and determining resistance-to-ground values of lightning protection system. Also instruct maintenance personnel in preparation and application of chemical solution for earth surrounding grounding rods for reducing ohmic resistance to required levels.

END OF SECTION
SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Uniform General Conditions, Supplementary General Conditions and Division 1 General Requirements apply to this Section.

B. Section includes: Description of project, definitions, references, contractor qualifications, supervision, equipment and materials, minimum requirements, workmanship, warranty, coordination drawings, storage and protection of materials, cutting and patching, concealment, rough-in, and submittals.

C. Each section following, including this is an integrated part of a whole. No section shall be issued alone. Parts 1 and 2 of each section may contain descriptions of general information and approved materials that are typically used industry-wide, but are not specifically part of this project. Part 3 - Execution of each section together with the drawings identifies the installation procedures for components that are included in this project. A brief synopsis of the work included in this project also follows below in Section 1.3.

D. The work covered by the communications specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of all communications work required in the contract documents and specified herein. The intent of the contract documents is to provide an installation complete in every respect. In the event that additional details or special construction may be required for the work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and labor in order to make the installation complete and operative.

E. All phases of work shall be sequenced under Section 01110 and the Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of other trades. Prior to the start of installation, contractor shall provide a detailed set of plans showing the coordination of pathways and termination equipment with Mechanical, Plumbing and Electrical drawings. Voice and Data Communications systems shall be independent of any other systems.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Division 27 Sections include:
   1. 27 05 00 Common Work Results
   2. 27 05 26 Grounding and Bonding
   3. 27 05 28 Pathways for Communications Systems
   4. 27 05 43 Underground Ducts and Raceways
   5. 27 05 53 Identification for Communications Systems
   6. 27 11 00 Communications Equipment Room Fittings
   7. 27 13 00 Communications Backbone Cabling
   8. 27 15 00 Communications Horizontal Cabling
   9. 27 16 00 Patch Cords, Station Cords, & Cross-Connect Wire
  10. 27 20 00 Data Communications Equipment
  11. 27 30 00 Voice Communications Equipment
  12. 27 40 00 Audio Visual System
  13. 27 51 00 Television Broadband Distribution

1.03 REFERENCES

A. Codes and Standards (Latest issue and addenda)
1. ADA Standards for Accessible Design 28 CFR Part 36
2. U.S. Department of Labor Occupational Safety & Health Administration (OSHA)
3. UNT Telecommunications and Infrastructure Requirements
4. BICSI TDM 11th Edition
5. National Electric Code (NEC), Latest Issue
6. ANSI/TIA568-C.1 - Commercial Building Telecommunications Cabling Standard*
7. ANSI/TIA568-C.2 - Commercial Building Telecommunications Cabling Standard*
8. ANSI/TIA568-C.3 - Optical Fiber Cabling Components Standard*
9. ANSI/TIA569-C - Commercial Building Standard for Telecommunications Pathways and Spaces*
10. ANSI/TIA 606-B - Administration Standard for Commercial Telecommunications Infrastructures, June 21, 2002*
11. ANSI J-STD-607-A, Commercial Building Grounding/Bonding Requirements- Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002*
12. ANSI/TIA758-B - Customer-owned Outside Plant Telecommunications Infrastructure Standard, May 2005*
14. Underwriters Laboratories (UL) Cable Certification and Follow Up Program*
15. National Electrical Manufacturers Association (NEMA)*
17. American National Standards Institute (ANSI), ANSI T1.404 (DS3) and CATV Applications
18. Institute of Electrical And Electronics Engineers (IEEE), IEEE 802.4 Broadband Applications and 802.7 Broadband Specifications Standard

B. Acronyms and Abbreviations
1. ADA Americans with Disabilities Act
2. AKA also known as
3. ANSI American National Standards Institute
4. AP access provider
5. ASTM American Society for Testing and Materials
6. AWG American Wire Gauge
7. BICSI Building Industry Consulting Services International
8. CATV community antenna television
9. CO-OSP customer owned outside plant
10. EF entrance facility
11. EIA Electronic Industries Alliance
12. EMI electromagnetic interference
13. FCC Federal Communications Commission
14. HVAC heating, ventilation, and air conditioning
15. IEEE The Institute of Electrical and Electronics Engineers
16. ITS Information Technology System
17. ISO International Organization for Standardization
18. LAN local area network
19. Mb/s megabits per second
20. MC main cross-connect AKA Main Distribution Frame (MDF)
21. MDF main distribution frame AKA main cross-connect (MC)
22. NEMA National Electrical Manufacturers Association
23. NESC National Electrical Safety Code
24. NFPA National Fire Protection Association
25. OFOI Owner Furnished Owner Installed
26. RCDD Registered Communications Distribution Designer
27. SCS Structured Cabling System
28. TBB telecommunications bonding backbone
29. TR telecommunications room AKA Intermediate Distribution Frame (IDF)
30. TGB telecommunications grounding busbar
31. TMGB telecommunications main grounding busbar
32. TIA Telecommunications Industry Association
33. UL Underwriters Laboratories
34. UTP  unshielded twisted-pair
35. WA  work area
36. WAP  wireless access points
37. X  cross-connect

1.04 PROPOSAL SUBMITTALS

A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.

B. Follow Division 1 and this section. All submittals shall be reviewed and stamped by the Contractor's project RCDD.

C. Submit a resume and copy of Building Industry Consulting Services International (BICSI) Registered Communication Distribution Designer (RCDD) certificate for Contractor's project RCDD.

D. A list of technical product education (training) completed by the Contractor's project personnel.

E. All members of the installation team must be certified by the Manufacturer as having completed the necessary training to complete their part of the installation. Submit resumes of the entire team and completed training courses and copies of BICSI Installer certificates TE300, training course IN100 and IN200.

F. Cable tester manufacturer or a third party certification for copper and fiber cable test technicians.

G. Price Quotation Information -
   1. Itemized Unit Pricing for Labor and Material;
   2. Itemized Add/Deduct Unit Pricing for Labor and Material for Pre-Cutover (200' average length) ONE (1) CAT 6 Drop;
   3. Itemized Add/Deduct Unit Pricing for Labor and Material for Post-Cutover (200' average length) ONE (1) CAT 6 Drop;
   4. Itemized Add/Deduct Unit Pricing for Labor and Material for Pre-Cutover (200' average length) TWO (2) CAT 6 Drop;
   5. Itemized Add/Deduct Unit Pricing for Labor and Material for Post-Cutover (200' average length) TWO (2) CAT 6 Drop;
   6. Itemized Add/Deduct Unit Pricing for Labor and Material for Pre-Cutover (200' average length) FOUR (4) CAT 6 Drop;
   7. Itemized Add/Deduct Unit Pricing for Labor and Material for Post-Cutover (200' average length) FOUR (4) CAT 6 Drop;

E. The Contractor shall review paragraph 1.3 of this Section; Codes and Standards - Latest issue and addendums and state understanding and compliance or exception.

F. Product Data: For each type of product indicated below. Product data to include, but not limited to, materials, finishes, approvals, load ratings, and dimensional information.
   1. Submittals shall include the manufacturers cut sheets for the following:
      a. Equipment enclosures and/or racks;
      b. Fiber optic and balanced twisted pair cable;
      c. Patch cords and cross connect media;
      d. Connectors and termination hardware;
      e. Protection hardware;
      f. Fire stopping materials;
      g. Test equipment to be used for fiber and balanced twisted pair channels;
      h. Cable tray and cable support hardware.

G. Product Data Manufactures literature sheets for all materials and equipment, including a copy of the proposed warranty, recommended preventative maintenance and spare part inventory recommendations. Literature containing more than one device shall be clearly marked to delineate item(s) included in the work. Clearly indicate color or special finishes.

H. Manufacturer and Contractor statement of RoHS: Restriction of Certain Hazardous Substances
Compliance.

I. Design and Installation Certificates: Signed by local cable manufacturer's representative certifying that design is acceptable with cable manufacturer’s Design Engineer(s) and Contractor is authorized by manufacturer to install registered (warranty) cabling system.

1.05 DESCRIPTION OF PROJECT

A. Main Distribution Frame (MDF) – Located on Level 2 of the Facility.

B. Pathways - Conduits will be installed by the electrical contractor. One (1) 1” EMT conduits will be placed from each communications device outlet into the ceiling spaces and will terminate within 6” above the nearest cable tray where practical. The conduit will be attached to the underside of the roof structure above the ceiling and the cable tray and will include a bushing-type coupler at the connection point. All conduit stub-ups will be terminated above into accessible ceiling spaces. Cabling, not in conduit or cable tray placed above the ceiling in the Health Professionals Building 1 will be supported on 48” maximum centers using J-hooks (see Section 27 05 28).

C. Horizontal cabling – Typical Data Outlet will consist of two (2) Data Cables. All horizontal cabling shall be plenum-rated.

D. Riser/Backbone/Tie Cabling - Multi-pair voice cabling and fiber optic backbone cables are required between the existing campus network and the new MDF, as well as between the MDF and each Telecom Room in the building. Sizes of copper and fiber optic backbone cables are established in Section 27 13 00-0 and Telecommunications Detail Drawings.

E. Relay Racks - All cabling shall be terminated to patch panels (data) mounted to 19”x7’0” floor-mounted relay racks in the ER and each TR. Refer to Telecommunications Detail Drawings for specifics. Section 27 11 00 establishes the requirements for the communications racks.

1.06 SUBMITTALS FOR PROJECT RECORD

A. Follow Division 1 and this Section.

1. Drawings: As-built documentation must be submitted five (5) business days prior to obtaining approval for cutover to any portion of the new cable plant system. Furnish for review and comments, 4 complete sets of E size (30 by 42) and 4 complete sets of C size as-built drawings along with 4 CDs containing all electronic AutoCAD 2000 or newer (DWG) files.

2. Final approved Shop Drawings: Include plan and elevation of TRs, cable pathway details, and cable locations and cable ID#.

3. 4 sets of cable inventory data must be submitted for all copper and fiber, termination hardware (prior to cutover to new cable plant if applicable.) Submit data in binders and electronically on CDs in "Microsoft Excel " format, listing products furnished, including:
   a. Manufacturer's name and part numbers.
   b. Cable numbers utilizing the Owner's cable numbering standard.
   c. Location and riser assignments.

4. Manufacturer Certificates: Within 10 days of completion of the project, Contractor shall deliver letter signed by local Structured Cabling Components representatives and Contractor's RCDD stating that installed cabling system complies with all requirements specified in manufacturer's installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.

5. Test Reports: 4 sets of hard copies with 4 copies on CD in compliance with related Test Result Documentation

6. Submitted test results and other submittals that are non-compliant will be reviewed and returned to the Contractor with comments.

7. Re-submitted test results and other submittals that are non-compliant will be reviewed and returned to the Contractor with comments.

8. Manufacturer's warranty to the Owner. This shall include, but is not limited to: Owner's name and project name and address. (Within three weeks of substantial completion).
9. Within 10 days of completion of the project, Contractor shall deliver letter signed by local SCS Manufacturers representative and Contractor's RCDD stating that installed cabling system complies with all requirements specified in installation guidelines and that there were no accidents, improper installation, mishandling, misuse, damage while in transit, unauthorized alteration, unauthorized repair, failure to follow instructions, or misuse with the structured cabling system that could adversely impact warranty.

10. Within 30 days of completion of a project, the communications contractor and/or the manufacturer's local representative will provide owner The Structured Cabling Performance Warranty signed by the manufacturer. The warranty shall list the owner and name of the Facility including location as the holder of the warranty.

1.07 DEFINITIONS

A. MER - Main Equipment Room: The main room, which typically contains the PBX, MDF and main Data Communications equipment.

B. TR - Telecommunications Room: Any additional room, which contains switches, hubs, patch panels and cross-connects away from a central location to serve areas out of distance from the MER.

C. TO - Telecommunications Outlet: Point of connectivity for voice, data or video on the wall or in the floor. Refer to Telecommunications Drawings and Symbol sheet(s) for quantities and types of media at each outlet.

D. MDF - Main Distribution Frame: A termination frame for unshielded twisted pair cable, usually providing a connection field for PBX telephone ports and feeder/riser cables to TR's. The MDF is normally located in the MER.

E. IDF - Intermediate Distribution Frame: A termination frame for unshielded twisted pair cabling providing a connection field for horizontal wiring from the workstation and feeder/riser cables extended from the MER.

F. PBX - Private Branch Exchange: Privately owned voice communications switch.

G. STUBBED OUTLET - A flush device box, 4-11/16" x 4-11/16" x 2-1/8" deep, with a single-gang extension ring installed behind sheet-rock walls or within concrete block walls. There shall be two (2) conduits a minimum of 1" installed to each device box (See drawing T3.03.05). The device box is centered at 18" a.f.f., and the conduit(s) rise to a point above the suspended ceiling or continues to an accessible ceiling for cable installation. The electrical contractor provides this work.

H. PROJECT MANAGER - An individual who manages the logistic requirements of projects such as personnel, material and schedules. This individual may be responsible for multiple projects.

I. SUPERVISOR - An individual who is responsible for a specific project and is on site 95% of the workday. This individual manages personnel assigned to the project, assures that materials are ordered, received and installed in a timely manner and, assures overall quality on the project. This individual must be a Registered Communications Distribution Designer in good standing with BICSI. Successful completion of the BICSI IST100 training course in addition to TE300 is required.

J. LEAD TECHNICIAN - An individual who is in charge of up to a maximum of 4 technicians. This individual is responsible for timely project completion and quality assurance. Successful completion of the BICSI TE300 training course and all its prerequisites is required.

K. TECHNICIAN, LEVEL II (Installer, Level 2) - An individual who possesses the training and skills necessary to qualify for and has successfully passed the requirements of the BICSI IN200 training course. This individual is responsible for his or her own work plus the work of not more than one (1) level 1 installer.

L. TECHNICIAN, LEVEL I (Installer, Level 1) - An individual who possesses the training and skills necessary to qualify for and has successfully passed the requirements of the BICSI IN100 training
1.08 CONTRACTOR QUALIFICATIONS

A. General Qualifications
1. Untrained, undocumented, or otherwise unqualified personnel are not allowed to perform any portion of the communications infrastructure installation.
2. All personnel must be permanent employees of the telecommunications contractor, or approved sub-contractors.

B. Voice/Data
1. Contractor shall have been in telecommunications business continually for at least the past 5 years.
2. A minimum of five (5) representative educational facilities projects must be submitted as references to include the school’s name, address, architect or Engineer, cost of the project and the contact person at the school district to include phone number.
5. Telecommunications contractor shall possess current certifications from CommScope/Systimax.
6. All project managers, supervisors, lead technicians, and technicians for the telecommunications contractor shall each possess individual certification(s) for the installation and testing of CommScope/Systimax voice/data and fiber optic cabling products.
7. Supervisor(s) shall possess BICSI certificates of completion for training courses IS100 and TE300.
8. Strongly Recommended: Lead Technicians shall possess BICSI certificates of completion for the training course TE300.
9. Strongly Recommended: Technicians shall possess BICSI certificates of completion for the training courses IN200 or IN100 for Installer Level 2 or Installer Level 1.

C. Audio/Video
1. Five (5) years’ experience in the installation of broadband distribution systems, including splicing, termination, and testing of copper coaxial cable.
2. Five (5) installed systems, comparable to the Owner's installation, where broadband distribution systems are installed and the systems have been in continuous satisfactory operation for at least one (1) year. The Contractor shall submit as proof, supporting documents and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the installed systems.
3. A minimum of five (5) representative educational facilities projects must be submitted as references to include the school’s name, address, architect or Engineer, cost of the project and the contact person at the school district to include phone number.
4. Installers must have been trained and experienced in the specific splicing, terminating and testing equipment to be used in the installation. Contractor shall possess any and all relevant certifications required by the manufacturer prior to installation of the manufacturer's specific products. Contractor shall provide a list of their technical support staff together with their work experience, training history and manufacturer’s certification.
5. Qualified Contractors shall submit proof of all certifications and experience detail with bid response.

1.09 SUPERVISION

A. All work performed under Division 27 shall be continuously supervised at the project site by a Registered Communications Distribution Designer (RCDD) in good standing with Building Industry Consulting Service International (BICSI).

B. The Project Manager shall be the main point of contact for the project between the Owner and the
Owner's assignee.

C. The contractor's Project Manager shall attend a pre-installation meeting with the Owner and design team prior to working on the project.

D. The site supervisor shall be assigned to the project site for 95% of the work week and shall be responsible for the management of Lead Technicians.

E. The Lead Technician shall be responsible for the direct supervision of not more than four (4) total Technicians, either Level II or Level 1.

F. A Technician, Level II shall be directly responsible for not more than one (1) Technician, Level 1.

1.10 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. All wiring, materials, and equipment must be listed and labeled by a nationally recognized testing laboratory.

B. Original Equipment Manufacturer (OEM) documentation must be provided to the Owner's Telecommunications Technical Representative, who certifies performance characteristics that meet TIA standards.

C. The Contractor shall structure and equip the cable and wire system to minimize vulnerability to single points of failure.

D. All parts shall be made of corrosion resistant materials, such as plastic, anodized aluminum, or brass.

E. All materials used in the installation shall be resistant to fungus growth and moisture deterioration.

F. An inert dielectric material shall separate dissimilar metals that are apt to corrode through electrolysis under the environmental operating conditions specified.

G. The Contractor shall ensure that the wire and cable allow detection and diagnosis of problems to achieve high reliability and availability.

H. The wiring, materials, and equipment furnished for this request shall be essentially the standard product of the Manufacturer.

I. Firestop all rated wall penetrations according to code requirements and industry standards.

1.11 WORKMANSHIP

A. All work shall be performed in a neat, workmanlike manner.

B. Cable trunks (bundles) shall be routed along or perpendicular to building lines.

C. Cable trunks shall be placed above installation-convenient pathways such as hallways.

1.12 WARRANTY

A. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Telecommunications Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities, which the Manufacturer and Contractor may have by law or by other provisions of the Contract Documents. In any case, such guarantees and warranties shall commence when the Owner accepts the telecommunications system, as determined by the Engineer, and shall remain in effect for a period of ONE (1) YEAR thereafter.
B. All materials, items of equipment and workmanship furnished under each Section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any Contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

C. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

D. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the Contractor for his respective work, as applicable, shall replace the affected part or parts.

E. An additional extended warranty is required for work on this project. The additions and/or extensions to the standard year guarantee previously described are to be provided in writing, by the Manufacturers. The warranty is to cover all parts and labor as specified below:
   1. a certified Systimax 25-year performance certification for:
      a. Category 6, horizontal and backbone copper cable and associated labor.
      b. Category 6, patch panels, blocks and associated labor.
      c. Category 6, data workstation outlets and associated labor.
      d. Single-Mode (OS1) & 50um Laser Optimized Multi-Mode (OM3) fiber optic cable and associated labor.
      e. Single-Mode and 50um Laser Optimized Multi-Mode patch panels, adapter plates, connectors, patch cords and associated labor.

F. Furnish, before the final payment is made, a written guarantee covering the above requirements.

G. Additional/extended warranty listed above is Non-negotiable, and cannot be amended through the submittal process.

1.13 COORDINATION DRAWINGS

A. It shall be the responsibility of the Contractor to consult the Architectural and Engineering Drawings and Details, thoroughly familiarizing himself with the type and quality of construction to be provided on this project.

B. The Telecommunications Drawings are diagrammatic in character and cannot show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of local ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate with all other trades in order to avoid interference between the various phases of work.

C. The approximate location of Telecommunications items is indicated on the Telecommunications Drawings. These drawings are not intended to give complete and exact details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the job site and will in all cases be subject to the approval of the Architect. The Architect reserves the right to make any reasonable changes in the location indicated without additional cost.

1.14 STORAGE AND PROTECTION OF MATERIALS

A. Wiring, materials, and equipment shall be delivered and stored in a clean, dry space.

B. All materials shall be properly packaged in factory-fabricated containers and protected from damaging fumes, construction debris, and traffic until job completion.

C. Refer to Division 1 for additional information.
1.15 CUTTING AND PATCHING

A. Where it becomes necessary to cut through any wall, floor or ceiling to install any work under this Section of the Contract, or to repair any defects that may appear up to the expiration of the guarantee period, such cutting shall be done under the supervision of the Architect/Engineer by the Contractor. The Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect/Engineer.

B. Patching of all openings cut by the Contractor, or repairing of any damage to the work of other trades caused by cutting or by the failure of any part of the work installed under this Contract, shall be performed by the appropriate trade but shall be paid for by the Contractor.

C. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact-type equipment shall not be used except where specifically acceptable to the Architect/Engineer.

D. All openings shall be restored to “as-new” condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

E. Coring through slabs after concrete placement will require X-ray to verify rebar location prior to coring. Contractor shall bear all costs associated with coring, including but not limited to coring and X-ray inspection. Core drill shall not cut any rebar.

F. Refer to Division 1 for additional information.

1.16 CONCEALMENT

A. No telecommunications cable or cable tray may be installed where physical access is not attainable.

B. If cable and/or cable tray must pass through areas obstructed by sheet-rocked ceilings and/or fire-rated walls, or exceeds 20’ over a solid sheet-rocked ceiling area, then access panels must be installed.

C. The Contractor shall determine whether access panels are required, by investigating the architectural drawings for this Contract. The Contractor shall also bear the cost of installation of any access panels.

1.17 ROUGH-IN

A. “Rough-in” shall be defined as incomplete installation of cable or equipment.

B. Where cable is to be roughed-in, the following conditions shall be met:
   1. Cables shall be run within active cabling bundles and dressed-out as same.
   2. Where cables are routed into stub-outs, at least 18” of cable shall be left coiled within the device box. Device box shall have an appropriate blank cover plate installed.
   3. Where no stubbed-out pathways are provided, leave roughed-in cables coiled near the center of the growth area with enough slack to reach the floor plus anyplace in the area and a minimum of 15’ for service loop.

Cables that are not to be terminated at patch panels in an MTR or TR shall be left coiled in the ceiling of the MTR or TR with enough slack to reach the floor plus across the MTR or TR to the opposite wall.

1.18 DOCUMENTATION

A. Documentation shall be provided in the form of as-built drawings, cable test records and O&M Manuals.
B. Refer to Section 01330 Submittals Procedures

C. Refer to Section 01340 Shop Drawings, Product Data, and Samples

1.19 SUBMITTALS

A. Refer Section 01340 - Shop Drawings, Product Data, Samples and Colors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Substitutions: See Section 01-60-00 - Product Requirements.

B. Special Note: UNT is a Panduit/Corning specific location and has requested that the Panduit 25 year Warranty be extended to this installation. This requires that:
   1. The installer of the telecommunications infrastructure be Panduit Gold and Corning certified.
   2. The jack inserts, patch panels and accessories must be manufactured by Panduit.
   3. The Category 6 cable must be manufactured by Panduit.
   4. The project shall be registered for warranty and test data submitted for acceptance by Panduit.

PART 3 EXECUTION

3.01 CABLE CONTRACTORS

A. Cable Contractor Qualifications
   1. The Cable Contractor shall have a workers’ compensation experience modification rating (EMR) of less than 1.0.
   2. The full time on-site supervisor shall be certified by the Manufacturer of the products being installed.
   3. The Cable Contractor shall have installed similar systems in at least one similar project in the year prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. The Cable Contractor shall provide the names and locations of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
   4. The Cable Contractor shall have a minimum of one (1) full time employee on staff that is a BICSI RCDD with experience in similar projects to review and approve the design and construction plans and inspect work and report status on a weekly basis.
   5. The Cable Contractor’s personnel shall have a complete working knowledge of low voltage cabling applications such as, but not limited to data, voice, video and audiovisual network systems.
   6. Untrained or otherwise unqualified personnel are not allowed to perform any portion of the communications infrastructure installation.
   7. The Cable Contractor’s personnel must be permanent employees of the Cable Contractor, or approved sub-contractors.
   8. The Cable Contractor shall review paragraph 1.5 B Codes and Standards - Latest issue and addendums (of this Section) and state compliance or exception to any code or standard.
   9. The Cable Contractor shall have been in telecommunications cabling business continually for at least 4 years.
   10. Eighty per cent (80%) of Cable Contractors’ personnel shall have a minimum of 3 years experience in the installation of the types of systems, equipment, and cables specified in this document.
   11. Fifty per cent (50%) of Cable Contractors’ personnel shall be certified by specified manufacturer(s) for Telecommunication cabling installations and maintenance of listed product.

3.02 SUBMITTALS
A. Provide a copy of the supervising Registered Communications Distribution Designer's current certificate.

B. Provide a copy of the proposed manufacturer's extended warranty.

C. Provide copies of resumes for each technician, lead technician, supervisor and project manager. Each resume shall be accompanied by each individual's training certificates.

D. Provide proof of ownership of the ANSI/TIA-568 standards, latest issue.

E. Provide proof of ownership of the Telecommunications Standards and Methods Manuals, eleventh edition.

F. Submit proposed layouts of Television Broadband Distribution System equipment and cable plant, including equipment rack layouts, system schematics and riser diagrams. All equipment, along with expected signal levels and equipment signal level values must be shown.

G. Submit records of Category 6 Cable Certification tests at time of substantial completion.

H. Submit records of fiber optic Power Meter and OTDR (Tier Two) Cable Certification tests at time of substantial completion.

3.03 RECORD DOCUMENTS

A. Maintain Project Record documents on a weekly basis.

B. Refer to Section 01780 Closeout Submittals for dispensation of all record documentation.

C. Refer to Section 27 05 53 Identification for Telecommunications Systems for details on Closeout Submittals required for warranty certification.

END OF SECTION
SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

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 specifies the requirements for the Pathways for Communications Systems for University of North Texas – Dining Hall, in Denton, Texas.
   B. Communication Pathways are defined to include, but are not limited to innerduct, conduit, pull boxes, sleeves, cable trays, supports, accessories, associated hardware and fire stopping materials. Final design and specifications for conduits shall be made by the Electrical Engineer of Record.
   C. The primary horizontal cable support system will be cable tray, installed as shown in T drawings. Cable tray will be properly grounded. Wall penetrations shall transition to properly firestopped 4” sleeves, then back to cable tray.
   D. Outlets having one single cable require a single gang box that stubs up into the accessible ceiling void via one (1) 1” conduit with pull string.
   E. Outlets having two or more cables require a double gang box with a single gang reducer that stubs up into the accessible ceiling void via one (1) 1” conduit with pull string.
   F. Conduit runs may not be longer than 100ft or have more than two 90-degree bends without the use of a properly sized junction box. Insulated throat compression fittings must be used for communications conduit runs, with termination points having plastic or grounding bushings installed.
   G. Riser sleeve in ER/TRs must be properly installed with bushings and firestop.
   H. Cables shall be neatly dressed along common paths with Velcro tie wraps with voice cables separated from data cables. Maximum number of cables per bundle shall not exceed manufacturer specifications.
   I. Layout cable pathway runs in advance to determine space requirement along pathways, and to ensure non-interference from other trade installations.
   J. Do not support communication pathway from or lay on ceiling suspension system or use electrical, plumbing, or other pipes for support. Communication pathway supports shall be permanently anchored to building structure or joist. Provide attachment hardware and anchors designed for the structure to which attached, and that are suitably sized to carry the weight of the pathway and cables to be supported. Confirm with architect and/or construction manager on installation procedures for cable support system prior to implementation.
   K. Work furnished and installed by Electrical Contractor as specified in this Section and as shown in E and T drawings includes:
      1. The conduits and back boxes for the work area telecommunications outlets.
      2. The floor poke through hardware.
      3. Fire stopping of cable tray and conduit cable pathway.
   L. Work furnished and installed by the Cable Contractor as specified in this section and as shown in E and T drawings includes:
      1. The overhead cable runway system (ladder rack) within the new MDF.
      2. Bonding and grounding of overhead cable runway system (ladder rack), racks and cabinets within the ER/TR.

PART 2 – PRODUCTS

2.1 GENERAL
A. Where conduit, pull boxes, cable tray and other raceway sizes are not specifically shown on contract drawings. All communication pathways shall be sized in accordance with the requirements of BICSI and the NEC. No conduit shall be less than 1”.

B. Conduits must be designed and installed in the most direct route possible from the telecommunications Room to the work area.

C. All conduit ends shall have plastic bushings installed before the cable is pulled into the conduit.

D. Conduits will not be run next to hot water lines, steam pipes, or other utilities that may present a safety hazard or cause a degradation of system performance.

E. Conduits entering the Telecommunications Room should be designed and located allowing for the most flexibility in the routing and racking of cables.

F. Conduits or conduit sleeves entering through the floor of the Telecommunications Room shall terminate four (4) inches above the finished floor.

G. All metallic telecommunications conduits entering the Telecommunications Room, Equipment Room, or Entrance Facility shall be bonded together, and bonded to the Telecommunications Main Grounding Busbar with a #6 AWG ground cable.

H. All in-use and spare conduits entering the Telecommunications Room, Equipment Room, or Entrance Facility shall be sealed to prevent the intrusion of water, gasses, and rodents throughout the construction project. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

I. All conduits and cables that penetrate fire rated walls or floors must be fire stopped.

J. All OSP conduits and innerduct, used and spare, shall be plugged with watertight plugs at both ends to prevent the intrusion of water, gasses, and rodents throughout the construction project. All OSP conduits shall have pull lines rated at a minimum of 90 kg (200 lb) pulling tension installed. The pull lines must be re-pulled each time an additional cable is installed. Prior to releasing the conduit for the installation of cables, all OSP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. All OSP conduits must be tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

2.2 CABLE HOOK SYSTEMS

A. J-hooks should be installed 4ft to 5ft apart. Uniform spacing should be avoided to minimize problems with signal degradation.

B. J-hooks should be supported from decking or building structure using methods approved by the manufacturer.

C. Cable count should not exceed manufacturer’s recommended maximum. Add separate parallel J-hook pathway should cable count require it.

2.3 CONDUITS AND FITTINGS

A. For each communication outlet indicated, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings, other components and accessories as needed to form a complete system of the same type indicated.

B. See SECTION 260533 - RACEWAYS, CONDUITS AND BOXES

C. Minimum conduit size for Telecommunications Outlets shall be 1 (one) inch.

2.4 WALL AND CEILING OUTLET BOXES

A. All wall outlets shall be mounted in a minimum four (4)-inch by four (4)-inch by two and one-half (2 1/2)-
inch deep double gang outlet box with a single gang mud-ring.

B. Outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.

C. See SECTION 260533 - RACEWAYS, CONDUITS AND BOXES.

2.5 PULL AND JUNCTION BOXES

A. Pull boxes used with telecommunications conduits in interior locations shall be rated NEMA-1. Pull boxes used in damp or wet locations such as plumbing chases or out of doors shall be rated NEMA-3R. Pull boxes shall be installed in conduits run at an interval no greater than every 100 feet. A pull box shall be installed in conduit runs whenever there are two 90° sweeps, or a total of 180° of sweeps, in a conduit run. A pull box may not be used to change the direction of a conduit run. Any deviations from these criteria must have prior approval from UNT IT.

B. See SECTION 260533 - RACEWAYS, CONDUITS AND BOXES

2.6 PLENUM RATED FIBER OPTIC INNERDUCT

A. All fiber shall be installed in 1 ¼” corrugated, non-metallic plenum rated innerduct when not installed in conduit or in utility tunnel tray.
   1. Innerduct shall be UL Listed with Flame Propagation compliant with UL 2024.
   2. Only manufacturer's fittings, transition adapters, terminators and fixed bends shall be used.

B. Products
   1. White or orange, plenum rated, UL Listed, flexible optical fiber/communication raceway.
   2. Recognized per NEC Articles, 770 and 800 for plenum areas for optical fiber and telecommunications cables.
   3. Provide all fittings to form a complete integrated raceway system.

C. Fabrication
   1. Footage shall be sequentially marked.

2.7 CABLE TRAY SECTIONS AND COMPONENTS

A. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Tray Sizes shall have 4-inch minimum usable load depth, or as noted on the drawing.

C. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard 12 foot lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

D. Tray widths shall be 18 inches or as shown on drawings.

E. All fittings must have a minimum radius of 24 inches.

F. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.

G Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum span indicated on drawings. Supports shall be constructed from 12-gauge steel formed shape channel members 1-5/8 inch by 1-5/8 inch with necessary hardware such as Trapeze Support Kits (9G-55XX-22SH) as manufactured by Cooper B-Line, Inc. [or engineer approved equal]. Cable trays installed adjacent to walls shall be supported on wall mounted brackets such as B409 as manufactured by Cooper B-Line, Inc. [or engineer approved equal].
H. Trapeze hangers shall be supported by 1/2-inch (minimum) diameter rods.

I. Barrier Strips: Shall be placed as specified on drawings and be fastened into the tray with self-drilling screws.

J. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.

PART 3 – EXECUTION

3.1 SUMMARY

A. Final design and specifications for the Communications Systems conduits shall be made by the Electrical Engineer and Architect of record.

B. Conduits shall be reamed to eliminate sharp edges. Metallic conduit shall be terminated with an insulated bushing. Refer to ANSI/TIA/EIA-606 and Section 27 05 53 for administration of the pathway system.

C. The inside of the cable tray or wireway shall be free of burrs, sharp edges or projections that can damage cable insulation. Abrasive supports (e.g., threaded rod) shall have the portion within the tray protected with a smooth, non-scratching covering so that cable can be pulled without physical damage. When a wireway passes through a partition or wall, it shall be an unbroken length. Installation of telecommunications cables shall not exceed the fill requirements. Openings in fire-rated walls, floors and ceilings shall be properly firestopped. Barriers between power and telecommunications cables shall be installed per electrical code. Cable trays and wireways shall not be used as walkways or ladders unless specifically designed and installed for that purpose.

D. Supports should be located where practicable so that connections between sections of the tray fall between the support point and the quarter section of the span. The support centers shall be in accordance with the load and span for the applicable class as specified in the electrical code. A support should be placed within 600 mm (2 ft) on each side of any connection to a fitting. Wireways shall be supported on 1500 mm (5 ft) centers unless designed for greater lengths.

E. A minimum of 300 mm (12 in) access headroom shall be provided and maintained above a cable tray. Care shall be taken to ensure that other building components e.g., air conditioning ducts) do not restrict access to trays or wireways.

3.2 MINIMUM CLEARANCES

A. Communication Pathway minimum clearances from:
   1. Minimum of 1 foot parallel, 3 inches crossover from power cables and conduits.
   3. Minimum of 24 inches Hot Flues, Steam pipes, Hot water pipes and other hot surfaces.
   4. Minimum of 3 feet separation from electrical panel boards.
   5. Minimum of 12-inches from fluorescent fixtures.
   6. Minimum of 6 feet separation from electrical motors and transformers.
   7. Minimum of 2-inches from exposed all-thread rods.

3.3 FIRE STOPPING.

A. Provide fire resistant materials to restore fire ratings to all wall, floor, or ceiling penetrations used in the distribution and installation for communications cabling system. Coordinate fire stopping procedures and materials with General Contractor and Electrical Contractor.

B. Solutions and shop drawings/submittals for fire stop materials and systems shall be presented to the General Contractor for written approval of materials prior to purchase and installation.

C. Materials shall be installed per manufacturer instructions, be UL listed for intended use, and meet NEC codes for fire stopping measures.
D. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and remain resilient and pliable to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

E. The fire stopping material shall maintain/establish the fire rated integrity of the wall/barrier that has been penetrated.

F. Cable Contractor shall laminate and permanently affix to the MDF wall, adjacent to chases, the following information:
   1. Name of manufacturer of fire stop system.
   2. Part & model numbers of system and all components.
   3. Phone numbers of manufacturer's corporate headquarters in U.S. and local distributor's name and phone number.

END OF SECTION 27 05 28
SECTION 27 05 53 - IDENTIFICATION OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the labeling of the telecommunications infrastructure as described on the Drawings and/or required by these specifications.
B. Labeling format is to be submitted to and approved by Owner prior to implementation.

1.02 RELATED SECTIONS

A. 27 05 00 Common Work Results
B. 27 05 13 Communications Services
C. 27 05 26 Grounding and Bonding
D. 27 05 28 Pathways for Communications Systems
E. 27 05 43 Underground Ducts and Raceways
F. 27 05 53 Identification for Communications Systems
G. 27 11 00 Communications Equipment Room Fittings
H. 27 13 00 Communications Backbone Cabling
I. 27 15 00 Communications Horizontal Cabling
J. 27 16 00 Patch Cords, Station Cords,& Cross-Connect Wire
K. 27 20 00 Data Communications Equipment
L. 27 21 33 Data Communications Wireless Access Points
M. 27 30 00 Voice Communications Equipment

1.03 QUALITY ASSURANCE

A. Identification and administration work specified herein shall comply with the applicable requirements of:
   1. ANSI/TIA - 606-B Administration Standards.
   2. ANSI/TIA – 569-C Pathway and Spaces
   5. UL 969.

1.04 TELECOMMUNICATIONS ADMINISTRATION

A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces.
B. UNT maintains a campus wide numbering scheme for voice and data outlets and patch panels.
C. Telecommunications Infrastructure Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A cable record is prepared for each backbone cable. The record will show the cable name, and must describe the origin point and destination point of the cable. The cable record will record what services and/or connections are assigned to each cable pair or strand. An equipment record is prepared for services distributed from a certain piece of equipment, such as a router, or a system such as the telephone system PBX.
D. UNT requires the installer to keep accurate, up-to-date Installation or Construction Drawings. At a minimum, the Installation Drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.
E. UNT requires the installer to provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, and wiring portions of the infrastructure which may each have separate drawings if warranted by the complexity of the installation, or the scale of the drawings.
PART 2 PRODUCTS

2.01 LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
C. Where insert type labels are used provide clear plastic cover over label.
D. Outside plant labels shall be totally waterproof even when submerged.
E. Approved Manufacturer:
   1. Panduit
   2. Brady Corporation
   3. Equivalent
F. Equipment Room Copper, Fiber, and Coax Backbone Cable Labels
   1. Panduit Part#LS7-75NL-1 or Brady#WML-1231-292
G. Equipment Room Copper, Fiber, and Coax Horizontal Cable Labels
   2. Panduit Part#LS7-75NL-1 or Brady#WML-317-292
H. Work Area Copper, Fiber, and Coax Riser Cable Labels
   1. Panduit Part#LS7-75NL-1 or Brady #WML-317-292
I. Patch Panel Labels
   1. Panduit Part #LS7-38-1 or Brady #CL-111-619

PART 3 - EXECUTION

3.01 IDENTIFICATION & LABELING

A. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.
   1. Orange – Reserved for identification of the telecommunication service demarcation point (demarc). Orange may only be used by the telephone company.
   2. Green – Used to identify the termination of network connections on the customer (Texas State University) side of the demarc.
   3. Purple – Used to identify cables originating from common equipment, such as the telephone PBX, LAN hubs, or multiplexer.
   4. White – Used to identify the first-level backbone telecommunications media termination in the building containing the main cross-connect. The main cross-connect is usually in the Equipment Room. In buildings that do not contain the main cross-connect, white may be used to identify the second-level backbone terminations.
   5. Gray – Used to identify the second-level backbone telecommunications media termination in the building containing the main cross-connect.
   6. Blue – Used to identify the termination of horizontal distribution cables routing from the Telecommunications Closet or Equipment Room to the Work-Area. A blue color coding is only required at the TC or ER end, not at the work-area end of the cable.
   8. Yellow – Used to identify termination of auxiliary circuits, alarms, maintenance, security, and other miscellaneous circuits.
B. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.
C. All labels shall be printed or generated by a mechanical device.

3.02 TELECOMMUNICATION IDENTIFIERS

A. All voice and data outlets and patch panels shall be clearly marked using permanent means. Voice and data outlets shall use the following system of numbering and labeling. Each cable shall be labeled with the MDF or IDF room number, and patch panel port number as well as the following:
1. OUTLET
   a. DATA: Actual IDF/TR Room Number and Patch Panel Port Number.
   b. VOICE: Actual IDF/TR Room Number and 110 block position.

2. MDF/IDF
   a. DATA: Room Number & Jack Number on Patch Panel.
   b. VOICE: Room Number and Jack ID.

3. When more than one TC is needed per floor, the room number of the TR shall be added to the numbering scheme.

4. When more than one data patch panel is needed per TC, the numbering scheme shall continue consecutively. Example: If two 48 port patch panels are needed, the second patch panel will be labeled starting with port 49.

5. All voice and data outlet and port numbering must match actual room numbers. Careful consideration should be given when developing and maintaining a numbering scheme that the scheme matches the actual room numbers exactly; not builder's room number.

6. All voice and data terminations in the TCs shall be made in a numerical order by room number of each jack.

7. Outlet numbers shall be marked by permanent means on each cable at the outlet and at the TC.

END OF SECTION
SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABELING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Specification Section 27 05 00, Common Work Results for Communications, apply to this Section.

1.02 SUMMARY

A. This Section specifies the requirements for the Communications Horizontal Cabling for the Interdisciplinary Research Building at University of Texas Health Science Center in Fort Worth, Texas.
B. All voice and data horizontal cables shall consist of plenum rated, Category 6, 4 pair UTP copper terminated in the ER and TR's. The voice/data cables shall terminate on 48 port RJ-45 T568B, The maximum horizontal distance shall be 295 feet.
C. All information outlets will be flush-type mounted into conduits and boxes. Typical outlets will be used in the office spaces and lab spaces. These outlets shall consist of 3 data cable unless otherwise specified. Each port in the data patch panel shall have 8 conductors configured to RJ45 (ISDN) standard pin-out T568B.
D. Outlet configurations. Single-gang mounting plate with modular openings which might contain one or more the following devices
   1. Data Jack(s) - 8-pin modular, Category 6, un-keyed, ivory, pinned to T568B standards (fully terminated).
   2. Blank Inserts – to be inserted in unused openings.
E. Contractor must keep updated redline drawings and provide as-built documentation in both print and electronic formats.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

2.01 Approved Materials

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<td>B. Chatsworth 19&quot; Relay Rack</td>
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<td>C. Chatsworth Junction Splice 90 Kit(BLK)</td>
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</table>
2.05 WALL PLATES
A. Unused ports shall have blank inserts installed.
B. Color shall be Ivory.
C. Faceplates shall have two separate labeling areas.
D. Label areas shall be covered with a clear plastic insert.
E. Label areas shall accept 9mm height labels.

2.06 OUTDOOR WALL PHONE ENCLOSURE
A. Gai-Tronics Corporation weatherproof or surface mount enclosures for outdoor telephone.

PART 3 - EXECUTION

3.01 GENERAL
A. Follow manufacturer's installation guidelines.
B. All data and voice cabling and terminations and termination hardware shall be ANSI/TIA wiring configuration T568B.
C. The length of each individual run of horizontal cable from the administration subsystem (Telecommunications Room) to the Telecommunication Outlet shall not exceed 295 ft.
D. The 4 pair UTP cable shall be Underwriter's Laboratories (UL) listed type CMP.
E. Pay strict attention to the manufacturer's guidelines on bend radii and maximum pulling tension during installation. Notice that the recommended minimum bend radius for a cable during installation is typically greater than the recommended bend radius after the cable is installed. This is to minimize tension and deformation as the cables pass around corners during installation. The maximum pull-force guideline for 4-pair horizontal balanced twisted pair cables is 110 N (25 lbf).
F. UTP Cabling:
   1. Provide a minimum of 3-foot service loop (for re-termination) for horizontal cables. Locate service loop where horizontal cable run transitions to cable tray. Place at least 12” of service loop in outlet box.
   2. The horizontal distance is the cable length from the mechanical termination of the media at the horizontal cross-connect in the telecommunications room to the telecommunications outlet/connector in the work area. The maximum horizontal distance shall be 295 ft, independent of media type. The length of the cross-connect jumpers and patch cords in the cross-connect facilities, including horizontal cross-connects, jumpers, and patch cords that connect horizontal cabling with equipment or backbone cabling, should not exceed 5 m (16 ft) in length. For each horizontal channel, the total length allowed for cords in the work area plus patch cords or jumpers plus equipment cables or cords in the telecommunications room shall not exceed 10 m (33 ft).
   3. Cable and components shall be visually inspected for proper installation. Cable stress, such as that caused by tension in suspended cable runs and tightly cinched bundles, shall be minimized. Plenum rated Velcro ties used to bundle cables should be applied loosely to allow the Velcro tie to slide around the cable bundle. The vector ties should not be cinched so tightly as to deform the cable sheath. Cable placement should not deform the cable sheath.
   4. Minimum bend radius: The minimum bend radius for cable will vary depending on the condition of the cable during installation (tensile load) and after installation when the cable is at rest (no-load).
   5. The minimum bend radius, under no-load conditions, for 4-pair unshielded twisted-pair (UTP) cable shall be four times the cable diameter.
   6. Copper cable splicing or bridge tapping is unacceptable.
   7. Cables should be terminated with connecting hardware of the same category or higher. To maintain the cable geometry, remove the cable sheath only as much as necessary to terminate the cable pairs on the connecting hardware. The connecting hardware manufacturer's instructions for cable sheath strip-back shall be followed. When terminating Category 6 and higher cables, the cable pair twists shall be maintained to within 13 mm (0.5
in) from the point of termination. For best performance when terminating cable on connecting hardware, the cable pair twists should be maintained as close as possible to the point of termination.

8. The Cable Contractor shall install 4-pair Category 6 plenum rated UTP cables from the appropriate ER or TR to each outlet location as indicated on the telecommunications drawings

### 3.02 SITE QUALITY CONTROL

**A. Site Testing and Inspection Agency qualifications:**

1. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA-568-C.2-1 “Transmission Performance Specifications for 4-pair Category 6 Cabling”. This document will be referred to as the “TIA Cat 6 Standard.”

2. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the telecommunication wall outlet in the work area against the “Permanent Link” performance limits specification as defined in the TIA CAT 6 Standard.

3. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

4. The test equipment shall comply with the accuracy requirements for level III field testers as defined in the TIA CAT 6 Document. 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 C.2 of Annex B of the TIA CAT 6 Standard. (Table B.3 in this TIA document specifies the accuracy requirements for the Channel configuration.)

5. The test plug shall fall within the values specified in E.3.2.2 Modular test plug NEXT loss requirements of the TIA CAT 6 Standard.

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. The Cable Contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. 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. One hundred percent of the installed cabling links must be tested and must pass the requirements of the standards in this section. 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 the Test Result Documentation as listed below.

**B. Site Testing, Inspection and Acceptance**

1. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or 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 or Pass*.

2. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.

3. A representative of the design team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing commences.

4. At the conclusion of field-testing, at a time scheduled by the owner’s representative, the owner’s representative will select a random sample (up to 10%) of the installed links in each wiring closet. The Cable Contractor, under supervision of the owner’s representative, shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in Test Result Documentation as listed below.

5. The results obtained shall be compared to the data originally provided by the Cable Contractor. If any (one or more) of the sample test reports displays a fail or fail* result, the Cable Contractor shall resolve any conditions causing the failed test and under supervision of the owner’s representative shall repeat 100% of the testing and the cost shall be borne by the Cable Contractor.

**C. Performance Test Parameters**

1. The test parameters for CAT 6 are defined in TIA CAT 6 standard, which refers to the ANSI/TIA-568-C.2 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 250 MHz) must meet or exceed

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4b TECHNOLOGY 271500-3

COMMUNICATIONS HORIZONTAL CABELLING
the limit value determined in the above-mentioned standard.

a. Wire Map
b. Length
c. Insertion Loss (Attenuation)
d. NEXT Loss
e. PSNEXT Loss
f. ELFEXT Loss, pair-to-pair
g. PSELFEXT Loss
h. Return Loss
i. ACR (Attenuation to crosstalk ratio)
j. PSACR
k. Propagation Delay
l. Delay Skew [as defined in ANSI/TIA-568-C.1; Section 11.2.4.11]

D. Test Result Documentation

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of
   the test.
2. The test results records saved by the tester 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. Superior protection in this regard is offered by testers
   that transfer the numeric measurement data from the tester to the PC in a non-printable format.
3. The database for the completed job shall be stored and delivered on CD-ROM including the software tools
   required to view, inspect, and print any selection of test reports.
4. 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.

5. 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 standard selected to execute the stored test results.
   e. The cable type and the 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 standards database in the tester.
   j. The test results information must contain information on each of the required test parameters.

6. The detailed test results data to be provided in the electronic database for each tested link must contain the
   following information:
   a. For each of the frequency-dependent test parameters, the value measured at every frequency during the
      test is stored. In this case, 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.
      1) Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to
         the nearest 0.1 m (1ft) and the test limit value.
      2) Propagation delay: Identify the pair with the shortest propagation delay, the value measured in
         nanoseconds (ns) and the test limit value.
      3) Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in
         nanoseconds (ns) and the test limit value.
4) Attenuation: Minimum test results for the worst pair.
5) Return Loss: Minimum test results for the worst pair as measured from each end of the link.
6) NEXT, ELFEXT, ACR: Minimum test results documentation as explained in Section I.B for the worst pair combination as measured from each end of the link.
7) PSNEXT, PSELFEXT, and PSACR: Minimum test results documentation for the worst pair as measured from each end of the link.

E. As-built drawings
1. Provide three (3) copies of E and three (3) copies of C size prints along with CADD files in .dwg or .dgn formats showing floor plans with room numbers and actual outlet locations and labeling. The deliverable is required within 5 business days of final cable testing.
2. Red Line Drawings: Contract must kept one (1) E size set of floor plans on site during work hours with installation progress marked and outlet labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.

END OF SECTION
SECTION 27 16 00 - COMMUNICATIONS CONNECTING CORDS, DEVICES & ADAPTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Uniform General Conditions, Supplementary General Conditions and Division 1 - General Requirements apply to this Section.
B. Section includes: Materials minimum requirements, workmanship, warranty, coordination drawings, storage and protection of materials and submittals.
C. Special Note: UNT is a Panduit/Corning specific location and has requested that the Panduit 25 year Warranty be extended to this installation. This requires:
   1. The installer of the telecommunications infrastructure to be a certified Panduit Gold and Corning Certified installer.
   2. The Category 6 Patch Cables are manufactured by Panduit.
   3. The project shall be registered for warranty and test data submitted for acceptance by Panduit.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Specification Section 27 05 00, Common Work Results for Communications, apply to this Section.

1.03 REFERENCES

A. Codes and Standards (Latest issue and addenda)
   1. ADA Standards for Accessible Design 28 CFR Part 36
   2. U.S. Department of Labor Occupational Safety & Health Administration (OSHA)
   3. UNTHSC Telecommunications and Infrastructure Requirements
   4. BICSI TDM 11th Edition
   5. National Electric Code (NEC), Latest Issue
   6. ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard*
   7. ANSI/TIA-568-C.2 - Commercial Building Telecommunications Cabling Standard*
   8. ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard*
   9. ANSI/TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces*
   10. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructures, June 21, 2002*
   12. ANSI/TIA758-B - Customer-owned Outside Plant Telecommunications Infrastructure Standard, May 2005*
   14. Underwriters Laboratories (UL) Cable Certification and Follow Up Program*
   15. National Electrical Manufacturers Association (NEMA)*

1.04 SUBMITTALS

A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.

1.05 WARRANTY

A. See Section 01-78-00 - Closeout Submittals, for additional warranty requirements.
B. All materials, items of equipment and workmanship furnished under each Section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any Contract, due to defective or improper
material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the
expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and
other systems resulting from this failure.

C. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of
sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

D. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period,
the Contractor for his respective work, as applicable, shall replace the affected part or parts.

E. An additional extended warranty is required for work on this project. The additions and/or extensions to the standard
year guarantee previously described are to be provided in writing, by the Manufacturers. The warranty is to cover all
parts and labor as specified below:

F. Ortronics 25-year performance certification for:
   1. Category 6, cable and associated labor.
   2. Category 6, patch panels and associated labor.
   3. Category 6, data workstation outlets and associated labor.

G. Furnish, before the final payment is made, a written guarantee covering the above requirements.
H. Additional/extended warranty listed above is Non-negotiable, and cannot be amended through the submittal process

PART 2 PRODUCTS

2.01 Approved Materials

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Chatsworth 12&quot; Black Ladder Rack</td>
<td>10250-712</td>
</tr>
<tr>
<td>B. Chatsworth 19&quot; Relay Rack</td>
<td>55053-703</td>
</tr>
<tr>
<td>C. Chatsworth Junction Splice 90 Kit(BLK)</td>
<td>11302-701</td>
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<tr>
<td>D. Chatsworth Rack To Runway Mounting Plate</td>
<td>10595-712</td>
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<td>E. Corning 2U Rack Mount Fiber Cabinet</td>
<td>CCH-02U</td>
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<tr>
<td>F. Corning 12 Strand MM 50/12510GIG Armored Fiber 012T88-33180-A3</td>
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<td>G. Corning MM Fiber Adapter Panel 6 Duplex LC</td>
<td>CCH-CP12-E4</td>
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<td>H. Corning MM LC Fiber Connectors</td>
<td>95-050-99-X</td>
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<td>I. Hilti 6' Hanger w/Yellow Shot</td>
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<td>J. Panduit 1.31&quot; J-Hook</td>
<td>JP131W-L20</td>
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<tr>
<td>K. Panduit 2 Module Surface Box</td>
<td>CBXJ2IW-A</td>
</tr>
<tr>
<td>L. Panduit 48-Port Mini-com Patch Panel</td>
<td>CPPL48WBLY</td>
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<tr>
<td>M. Panduit 4-Port Sloped Executive Faceplate</td>
<td>CFPS4IW</td>
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<tr>
<td>N. Panduit 6&quot; Vertical Manger</td>
<td>PRV6</td>
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<td>O. Panduit 6&quot; Vertical Manager Door</td>
<td>PRD6</td>
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<td>P. Panduit Category 110 Rack Mount Panel</td>
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<td>Q. Panduit Category 110 Rack Mount Panel w/Jumper</td>
<td>P110B1005R4WJY</td>
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<td>R. Panduit Category 5e 48-port Patch Panel</td>
<td>DP485E88TGY</td>
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<td>S. Panduit Category 6 Mini-Com TX-6 Module (Green)</td>
<td>CJ688TGGR</td>
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<td>T. Panduit Category 6 Mini-Com TX-6 Module (Red)</td>
<td>CJ688TGRD</td>
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<td>U. Panduit Category 6 Mini-Com TX-6 Module (White)</td>
<td>CJ688TGIW</td>
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<td>V. Panduit Category 6 Patch Cord (Green) 5ft</td>
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<td>W. Panduit Category 6 Patch Cord (Yellow) 5ft</td>
<td>UTP28SP5LY</td>
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<td>X. Panduit Category 6 Patch Cords (Green) 14ft</td>
<td>UTPSP14GGRY</td>
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<tr>
<td>Y. Panduit Category 6 Plenum Cable Blue</td>
<td>PUP6004BU</td>
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<td>Z. Panduit Category 6 TX-6 Module (Yellow)</td>
<td>CJ688TGYL</td>
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<tr>
<td>AA. Panduit Front Only Horizontal Wire Manager</td>
<td>NC4M6F2</td>
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<td>BB. Panduit J-Hook 2&quot;</td>
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<td>CC. Panduit Voice Patch Cord (White) 7ft UTP</td>
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<td>DD. Superior Essex 50-Pair Category 3 Plenum Feeder</td>
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<td>EE. Corning I/O Armored 12 Strand Single Mode Fiber</td>
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<tr>
<td>FF. Corning ST Singlemode Adapter Panel</td>
<td>CCH-CP12-19T</td>
</tr>
<tr>
<td>GG. Corning ST Singlemode Fiber Optic Connector</td>
<td>95-200-52</td>
</tr>
</tbody>
</table>
PART 3 EXECUTION

3.01 COPPER PATCH CABLES
A. Provide two (2) patch cables for each "wired for" voice/data circuit.
C. Lengths shall be 50% 1’ and 50% 15’

3.02 FIBER OPTIC PATCH CABLES
A. Provide duplex fiber optic patch cables for each strand of fiber optic cable installed.
B. Lengths shall be 50% 1m, 40% 3m and 10% 5m

END OF SECTION
SECTION 28 2300 - VIDEO SURVEILLANCE

PART 1 – GENERAL

1.1 SECTION INCLUDES
   A. Cameras.
   B. Control equipment.
   C. Cable and accessories.

1.2 RELATED SECTIONS
   A. Section 28 1600 - Intrusion Detection.
   B. Section 28 1300 - Access Control.

1.3 REFERENCES

1.4 SYSTEM DESCRIPTION
   A. The UNT video surveillance system is an Internet Protocol (IP) camera based system that runs off of signal
      and low voltage power generated by a Power over Ethernet (PoE) data network switch and using signals
      transmitted over Local and Wide Area Network cable.
   B. All cabling used for camera image transmission is the same type used for high end data networks,
      Category 6 Unshielded Twisted Pair copper. Communications specifications sections should be adhered to
      for installation of Category 6 cabling.
   C. Camera data in recorded on viewed from an existing central storage device.
   D. Camera software licenses may be required to add additional camera to the existing system.

1.5 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate electrical characteristics and connection requirements, including system wiring
      diagram.
   C. Product Data: Provide showing electrical characteristics and connection requirements for each component.
   D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by
      product testing agency. Include instructions for storage, handling, protection, examination, preparation,
      installation, and starting of product.
   E. Project Record Documents: Record actual locations of cameras and routing of television cable.
   F. Operation Data: Instructions for starting and operating system.
   G. Maintenance Data: Routine trouble shooting procedures.

1.6 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

E. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.7 MAINTENANCE SERVICE

A. Furnish service and maintenance of television system for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 COMPONENTS - CAMERAS

A. Indoor/outdoor wide fixed: Advidia E-37-V

B. Outdoor/indoor fixed: Advidia E-37-FW

C. Indoor 360 Advidia A-427-V

2.2 ACCESSORIES

A. Main Video Cable: Category 6
   1. Product: As determined by Section 27 15 00.

B. Cabinet: Free-standing equipment rack (Provided by Communications Installer).
   1. Size: As indicated.

2.3 VMS, LICENSES AND STORAGE

A. Video Management System – Video Insight 7

B. Provide all camera licenses as required for a fully functional system

C. Provide a quote for a Video Insight IP Server and storage to allow for 30 days of storage at 16 hours of motion per day to estimate total storage needs.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Interface installation of video surveillance with security access and intrusion detection systems.

3.3 MANUFACTURER’S FIELD SERVICES
A. Provide the services of manufacturer's technical representative to prepare and start systems and supervise final wiring connections and system adjustments.

3.4 ADJUSTING

A. Adjust manual lens irises to meet lighting conditions.

3.5 DEMONSTRATION

A. Demonstrate system operation and provide two hours of instruction with manufacturer's training personnel.

B. Conduct walking tour of project and briefly describe function, operation, and maintenance of each component.

END OF SECTION 28 23 00
FIRE ALARM SYSTEM
SECTION 283100

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of Division 1, General Requirements and other provisions of the contract documents apply to this work.

B. This Section intends to describe an integrated fire detection and voice evacuation system to be intelligent device addressable, analog detecting, low voltage and modular with multiplex communication techniques, in full compliance with all applicable codes and standards. The features described in this specification are a requirement for this project and shall be furnished by the successful contractor. The contractor is responsible for the design and installation of the fire alarm system. A fire alarm design is not shown on the plans. The system shall be designed by the fire alarm manufacturer to meet the requirements of the latest edition of NFPA 13, 25, 72, 90A, 101, International Building Code, ASME A17.1, ADA/TDLA and any other local and state codes. Refer to mechanical, plumbing and security plans for coordination of those systems with the fire alarm system.

1. The system as described shall be installed, tested, and delivered in full operating condition. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether itemized or not.

2. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years. The equipment manufacturer shall have an installed base of analog systems as a reference. In the interest of job coordination, the installing contractor shall contract with a single source for supplying job materials, services, and programming, including final inspection/test services for the fire alarm system.

3. The equipment, space requirements, expansion capabilities and features specified were selected to meet the requirement for this project.

a. Manufacturers:

   1) Notifier NFS2-3030, no exception. Panel shall be campus standard and include:

      i. Notifier embedded gateway (NFN-GW-EM-3)
      ii. Notifier high speed network communications module (HS-NEM-W)
      iii. Digital Voice Communication EM
      iv. DAA Series digital Audio amplifiers

1.2 MATERIALS AND SERVICES

A. The system shall include, but not be limited to the following elements:

1. Master system CPU including all fire detection, voice/audio and visual evacuation alarm control modules, supervised power amplifiers with the required back up modules.

2. Circuit interface panels including all modules.

3. Power supplies, batteries and battery chargers.

4. Pre-amplifiers, amplifiers, and tone generators.

5. Equipment enclosures.

6. Intelligent addressable manual pull stations, heat detectors, analog smoke detectors, alarm monitoring modules, and supervised control modules.

7. Annunciator panel and printer.

8. Voice/Audible and visual evacuation signals.

9. Color graphic displays and historical archiving.
10. Software and firmware as required to provide a complete functioning system.
11. Wiring and raceway.
12. Installation, testing and certification and training.
13. Interface with security system per Paragraph 1.10.
14. Interface with air handling units.
15. Connection to MDF room via fiber for remote monitoring by the UNT Fire Systems Group.
16. Remote annunciator panels at each building entrance door or as required by the AHJ.

1.3 REFERENCE STANDARDS

A. The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. Texas Department of Insurance (TDI) State Fire Marshal's Office
   c. NFPA 70 National Electrical Code.
   d. NFPA 72 Standard for the Installation, Maintenance and use of Protective Signaling Systems.
   e. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
4. Underwriter's Laboratories, Inc. (UL).
   a. Appropriate UL Standards.
   b. UL FPED.
5. Texas Department of Licensing and Regulation.
7. Texas Accessibility Standards (TAS)

1.4 QUALIFICATIONS OF THE INSTALLER

A. Before commencing work, submit data showing that the contractor has successfully installed fire alarm systems of the same type and design as specified, or that they have a firm contractual agreement with a subcontractor having the required manufacturers' training and experience. The contractor shall include the names and locations of at least two installations where the contractor, or the subcontractor above, has installed such systems. Specify the type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding 18 months.

1.5 MANUFACTURER'S REPRESENTATIVE

A. Provide the services of a representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State of Texas. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the Owner's personnel in the system operation, maintenance and programming.
1.6 SUBMITTAL

A. The contracting firm shall be submit copies of its Texas Department of Insurance (TDI) Fire Alarm Contractor Registration (ACR), Fire Alarm Planning Superintendent License (APS) and the required TDI’s Liability Insurance Certificate, signed by a Texas Insurance Agent.

B. The contractor shall include the following information in the equipment submittal:
   1. Power calculations.
      a. Battery capacity calculations. Battery size shall be a minimum of 150% of the calculated requirement.
      b. Supervisory power requirements for all equipment.
      c. Alarm power requirements for all equipment.
      d. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition.
      e. Justification showing power requirements of the system amplifiers.
      f. Voltage drop calculations for wiring runs demonstrating worst case condition.
   2. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
   3. Submit panel configuration and interconnection of modules and all other data as required to make an informed judgment regarding product suitability. At a minimum, data shall be submitted on the following:
      a. Master system CPU including all fire detection, voice/audio and visual evacuation alarm control modules, and supervised power amplifiers with the required back up modules.
      b. Circuit interface panels including all modules.
      c. Power supplies, batteries and battery chargers.
      d. Pre-amplifiers, amplifiers, tone generators, master microphone and master telephone.
      e. Equipment enclosures, including dimensions and weights of completed units.
      f. Intelligent addressable manual pull stations, heat detectors, analog smoke detectors, alarm monitoring modules, and supervised control modules.
      g. Annunciator panel and printer.
      h. Audible and visual evacuation signals and devices.
      i. Software and firmware as required to provide a complete functioning system.
      j. Circuiting, including conduit and wire sizes.
   4. Data describing more than one type of item shall be clearly marked to indicate the type the contractor intends to provide for options not crossedout in submittal material will be furnished for the project. All submittal material shall be complete. Partial submittal will not be evaluated and will be rejected without comment. The contractor shall submit copies of UL listing or FM approval data showing compatibility of the proposed device or appliance and the panel being provided.
   5. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
      a. Floor plans showing all communicating, initiating, end of line, supervisory, indicating appliances, and output control devices; including circuit interface panels, message digitizers, amplifiers, annunciators, printers, video display terminals, color graphic displays, transponders and the main CPU locations. Raceways shall be shown, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used. Drawings shall indicate ambient sound levels used by the system installer for sound level calculations and mathematical justification.
for signal placement to meet the code required 15dBA above ambient for audible warning signals.

b. Wiring diagrams showing points of connection and terminals used for all electrical connections to the system devices and panels.

6. A complete proposed system database including a description of all logic strings, control by event programming and point identification labels on a 3.5" high density floppy disk or CD ROM and in a formatted printed form, as required for offsite editing, uploading and downloading shall be submitted for evaluation by the owner. A programming manual shall accompany the submitted program and shall be adequate to allow understanding, operation and editing by the system owner.

7. Statements shall be included, with copies of required licensing, verifying the qualifications of the installer as specified.

8. The fire alarm system subcontractor or manufacturer shall offer, for the owner's consideration at the time of system submittal, a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of NFPA 72.

B. For use in system test, a complete operation and maintenance manual with two sets of proposed installation drawings shall be submitted.

1. The following information shall be inscribed on the cover:
   a. "OPERATION AND MAINTENANCE MANUAL"
   b. Building location.
   c. The name of the contractor, system manufacturer and system subcontractor.
   d. The name and phone number of the fire department required to respond to alarms at the project location.

2. The manual shall be legible and easily read with large drawings folded and contained in pockets. Included in the manual shall be circuit drawings, wiring and control diagrams with data to explain detailed operation and control of each item of equipment and a control sequence describing start up instructions. Included shall be installation instructions, maintenance instructions, safety precautions, test procedures, performance data, and software documentation.

C. Upon completion of the installation, record drawings shall be submitted on each system before final acceptance of the work. The contractor shall furnish to the Owner a set of record drawings including system diagrams for each system. The record drawings masters shall be on reproducible mylar film, uniformly sized as required for legibility and reproduction and on high density floppy disks or CD ROM in an AutoCAD DXF format.

1.7 SYSTEM FUNCTION

A. The system shall be a complete, electrically supervised multiplex style fire detection and voice evacuation system with intelligent analog alarm initiation, to be device addressable and annunciated as described and shown on the drawings.

1. The maximum number of devices on a single signaling circuit shall not exceed 60, in order to avoid catastrophic loss of device communications in the event of a raceway destruction, with a capacity of 60 reporting system inputs and 60 system control outputs. Systems capable of serving in excess of 60 devices to be addressed on as single analog communications network shall be wired and controlled in a Style 7 configuration including isolation circuitry limiting any short circuit fault to a maximum of 60 addresses and/or a single smoke zone, whichever is less. Device wiring in the Style 7 configuration shall be installed in a manner eliminating the possibility of exiting wiring sharing the same raceway as the entry wiring for any device.

a. Devices attached to the signaling circuit shall be individually identifiable at the control panel for alarm and trouble indication. Smoke detectors shall be interrogated for sensitivity settings from the control panel, logged for sensitivity changes indicating the
4. The system shall annunciate a pre-clean trouble condition when any smoke detector reaches 80% of the allowable threshold movement within the prescribed UL window due to gradual contamination, signaling the need for service, and eliminating unwanted alarms. Upon reaching 100% of the allowable movement, a second “Detector Dirty” message with a trouble condition shall be displayed.
   a. The trouble report shall annunciate the specific location of the smoke detector requiring service. All analog smoke detectors installed in the system shall include this feature.
   b. Upon completion of the cleaning of the device, the system shall reestablish the average chamber voltage file, determining if the detector sensitivity falls within
the required window, and display a "Detector Cleaned" message. The detector cleaning shall be logged to the system history file.

5. Any intelligent analog smoke detector shall include a selectable alarm verification capability. This feature shall provide automatic verification of smoke detector alarms as described by NFPA 72. The system shall have the capability of logging to historical memory, the time and date of all unverified alarm events in order to track activity and generate reports indicating maintenance requirements prior to failures within the system.

6. All external circuits shall be listed as power limited circuits per the National Electric Code. Power limitation shall be provided using on board, self-restoring solid state thermal devices. Units using fuses or manually restorable circuit breakers for this purpose or requiring board replacement or exchange will not be acceptable.

7. The system shall recognize initiating of an alarm and indicate the alarm condition in a degraded mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.
   a. Each circuit interface panel shall be capable of operation in its own degrade mode. In this mode, the system shall receive an alarm from any intelligent analog or conventional initiating device. It shall activate local indicating appliances and remote or auxiliary connect circuits.
   b. The system shall indicate a trouble condition during degrade mode operation and shall give a visual indication of an alarm condition.
   c. Detector operation in the degrade mode shall continue at the alarm threshold previously programmed. Systems returning detectors to a common default value in degrade mode shall not be acceptable.

8. The system shall provide a default operation program to allow reporting of alarms from installed devices before loading of custom system software.

9. The system shall report alarms from installed devices but not yet added to the system custom program. Alarm reports from these devices shall activate indicating appliance circuits.

10. The system shall perform time based control functions including automatic changes of specified smoke detector sensitivity settings. Time based functions shall be controlled by specifying time periods or actual dates. It also shall provide the ability to control these functions on an exception basis using a holiday schedule.

11. The system shall provide a one person field test initiated from the control panel of either the complete system or a specified area supported from either the master control panel or any remote circuit interface panel, maintaining full function of areas not under test.
   a. Field test shall be usable in a silent or audible mode. When in the audible mode, the signals shall audibly annunciate alarms, troubles and device types, each in a way identifiable by the testing technician.
   b. All field test activity shall be logged to the system printer and historical memory. It shall be possible to download historic memory to a data base program prior to, and subsequent to the walk test in order to establish a continuous system history. Historic memory shall accommodate a minimum of 800 events to prevent overflow during testing.

12. The system shall be provided with eight levels of password protection with up to forty passwords. In addition the system shall provide for up to sixty four password protected sublevels protecting functions or groups of functions under operator control. Passwords and functions shall be field programmable.

13. The system shall be programmed in the field via a laptop computer. All programmed information shall be stored in nonvolatile memory after loading into the control panel. No special programming terminal or prom burning shall be required and the system shall continue in service during reprogramming. Systems requiring on line terminal programming or not capable of mass reading of panel software for offsite documentation or editing will not be considered acceptable.
a. During program reading or loading, the system shall retain the capability for alarm reporting.

b. The system shall read to a PC for program editing. System program shall be stored on a floppy disk or CD ROM and all programming shall be multilevel password protected.

c. A.U.L. recognized programming utility shall be furnished to compare all altered functions, and input or output addresses, listing all related functions, inputs and output addresses that are effected by the program changes. These items shall constitute a minimum for required certification re-testing of the system in addition to the system device percentage mandated by the codes. Systems not providing this utility shall not be acceptable due to the expense related to complete re-testing for re-certification after program changes. The system shall consist of a central or distributed multiplex architecture using a centrally located control unit with interconnection to remote circuit interface panels containing any combination of pluggable intelligent analog signaling circuits and plug in relays.

d. The remote circuit interface panels shall as a minimum, provide a power supply, microprocessor controlled bus structure, battery and automatic charger, and communication link to the main CPU through a high speed 19.2K baud RS-485 network.

1) The high speed communications network shall be capable of Style 7 configuration, and when wired in this configuration, both outgoing and incoming paths shall be used for system activity as a means of assuring system response in the event of a loss of wiring continuity.

2) The high speed communications network shall support the use of fiber optics transmission techniques for the elimination of all electrostatic and electromagnetic induced electrical interference configured as a star loop.

e. The network communications format shall include error checking of the installation location of each module address to verify the agreement between programmed software and installed hardware as a protection against card installation in incorrect plug in slots. Module printed circuit cards shall be configured within each cabinet to physically prevent the installation of a card in an incorrect slot in that cabinet.

14. The system shall support a UL listed supervised printer at any designated alpha-numeric annunciator.

15. The system shall provide status indicators and control switches for all of the following functions:

a. Audible and visual evacuation alarm circuit zone control.

b. Status indicators for sprinkling system water flow and valve supervisory devices.

16. The system as installed shall be expandable to its predetermined maximum capacity of 200 initiation devices and/or 200 combined zones of speakers, and visual devices using installed software, with no chip changes or additions required for expansion.

17. The system shall support a UL listed supervised printer. Multiple unsupervised ancillary printers also shall be supported as approved or required by the authority having jurisdiction.

18. The system shall be listed by the UL for configuration as an approved NFPA 13 fire sprinkler system deluge and pre-action releasing system.

1.8 SYSTEM ZONING

A. Each intelligent addressable device on the system shall be displayed at the fire alarm control panel by a unique alpha numeric label identifying its location.

1.9 SYSTEM OPERATION

A. Activation of any fire alarm initiating device shall cause the following actions and indications, unless otherwise noted below:
1. Display a custom message, describing the device originating the alarm condition at the main fire alarm control panel and remote annunciator.

2. Report to the UNT Police via dialer. Two telephone lines shall be provided. Coordinate requirements with UNT and telecom plans.

3. Sound an alarm tone for a maximum of five seconds followed by an automatic digital voice message over all alarm circuits. At the end of the voice message, the alarm tone shall resume. The audio alarm signals shall sound alternately until the signal silence switch is operated.
   a. All audio operations (speaker circuit selection and alarm tone/voice messages and timing variations) shall be activated by the system software, so that future changes can be implemented without rewiring or hardware additions. Audible signals shall be silenceable from the fire alarm control panel by an alarm silence switch. The alarm indication shall be transferred to a visual indicator on the control panel and the alarm signals shall resound for a subsequent alarm condition, reported by a different device. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.
   b. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow greater than or equal to a single head.
   c. Status lights next to speaker selection switches on the control panel shall indicate which of the three messages each speaker circuit is distributing.
   d. Provisions for total building paging shall be accomplished by an 'All circuits switch'.

4. Record within the non-volatile system historical memory, the occurrence of the event, the time and date of occurrence and the device initiating the event. In addition, all operator actions shall be logged to system history with time and date.

5. Activation of an AHU duct detector shall shutdown that AHU only and shall not sound a general alarm.

B. Activation of any alarm verified smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described in 1.9A above, cause the recall of that bank of elevators to the terminal floor and the lockout of controls. In the event of recall initiation by a detector in the terminal floor lobby, the recall shall be to the alternate floor. Activation of any heat detector in the elevator machine room/pit shall shunt trip the circuit breakers serving the associated elevators.

C. Activation of any air duct detectors shall shutdown that unit.

D. Activation of any supervisory circuit; i.e., supervised valve closure, air pressure abnormal, low temperature, fire pump trouble shall cause the following actions and indications:
   1. Display the origin of the supervisory condition report at the main fire alarm panel and remote annunciator alphanumeric LCD display.
   2. Activate supervisory audible and visual signals as indicated on the drawings. Audible signals shall be silenced from the fire alarm control panel by an alarm acknowledge switch. The supervisory indication shall be transferred to a visual indicator on the control panel and the supervisory signals shall resound for a subsequent supervisory condition, reported by a different device.
   3. Record within system history the occurrence of the event, the time of occurrence and the device initiating the event.

E. Receipt of a trouble report; i.e., primary power loss, open or grounded initiating or signaling circuit wiring, open, grounded or shorted indication system wiring, device communication failure, battery disconnect at the fire alarm control panel shall cause the following actions and alarms:
   1. Display at the main fire alarm panel and remote annunciator alphanumeric LCD display, the origin of the trouble condition report.
   2. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
a. Audible signals shall be silenced from the fire alarm control panel and remote annunciator by a trouble acknowledge switch. The trouble indication shall be transferred to a visual indicator on the control panel and the trouble signals shall resound for a subsequent trouble condition reported by a different device.

b. Trouble conditions which have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.

3. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

1.10 SECURITY SYSTEM INTERFACE

A. Automatic Unlock of Electric Locking Mechanisms.
   1. Fail-safe security electric locking mechanisms as indicated on the security plans shall be automatically unlocked by the security system upon a fire alarm condition.
   2. To provide for automatic unlocking, the fire alarm contractor shall provide a normally closed auxiliary dry output contact from the fire alarm system. Upon a fire alarm condition the contact shall open and the security system shall unlock the electric locking mechanisms. The contact shall remain open until the fire alarm system is manually reset.

   1. Security electric locking mechanisms as indicated on the security plans shall be manually unlocked from a switch at the main fire alarm control panel.
   2. To provide for manual unlocking the fire alarm contractor shall provide a toggle switch in the main fire alarm control panel. Upon activation of the switch a normally closed dry contact shall open and the security system shall unlock the electric locking mechanisms. The contact shall remain open until the switch is returned to the locked position.
   3. The fire alarm contractor shall provide an additional normally closed dry contact from the switch for security system monitoring of the position status of the switch.

C. Automatic Bypass of Card Reader Control of Elevators.
   1. The card reader control of elevators shall be automatically bypassed by the security system upon a fire alarm condition.
   2. To provide for automatic bypass the fire alarm contractor shall provide a normally closed dry output contact from the fire alarm system. Upon a fire alarm condition the contact shall open and the security system shall bypass the card reader control of elevators. The contact shall remain open until the fire alarm system is manually reset.

D. Submittal.
   1. Submit product specifications, fabrication shop drawing, and wiring diagrams for the following:
      a. Interface terminal box
      b. Manual unlock switch

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

A. Fire alarm control panel shall be designed for mounting where indicated on the drawings.

B. The control panel shall be modular in construction and shall include, but not be limited to; the hardware, software and firmware required to perform the following major system functions:
   1. Surface mounted steel cabinet with indicator viewing window, hinged door and cylinder lock, dead front construction with outer door open, and factory finished in baked black enamel.
2. System power supplies, including necessary transformers, rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.

3. System 16 bit core processor, with internal operating system to process incoming alarm signals and issue output commands required as a result of the alarm reception, by system programming or manual commands. Total system response time shall not exceed 2.5 seconds on a system configured to the 3000 address maximum capacity. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with a single watchdog circuits for all processors shall not be acceptable.

4. NFPA 72 Style 4 system digital communication capabilities required for the control panel to communicate with remote circuit interface panels, annunciators, and displays. All communications shall be conducted in digital format. Systems utilizing communications signals of pulse width or voltage level techniques are not considered acceptable.

5. NFPA 72 Style 4 operation with loop isolator analog signaling circuitry required to communicate with, and receive alarms from 120 points, consisting of a maximum of sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Analog loops shall be configured with loop isolators and wired in a manner that prevents a catastrophic wiring event on a floor from effecting the performance of other floors.
   a. Systems allowing more than sixty devices per addressable loop shall be wired in a Style 7 configuration with raceway design configured to allow a maximum of one section of the loop within a single raceway.
   b. All communications shall be conducted in a digital format. Systems processing signals using pulse width or voltage level techniques are not considered acceptable.

6. A limited energy output circuit for operation of direct current audible or visual devices.

7. A drill function on the panel that is easily identifiable and only initiates notification appliances on all floors.

8. A programmable bypass function for AHU shut down, elevator recall, stairwell pressurization fans, notification appliances and alarm verification.

9. Where control of operations requiring switching functions is required, there shall be provided a software controllable relay module.

10. Mother boards shall be provided as the system bus furnishing systems communications to the various plug in modules required for system operation and expansion.

11. The integrated voice system shall operate up to three voice channels simultaneously; Evacuation, Alert and Auxiliary. Systems using a dedicated paging channel shall not be considered equal.

12. The integrated voice system shall utilize local and distributed amplification as required for optimum system performance and configuration.

13. The voice system amplifiers shall be capable of operating 25v rms and/or 70v rms speakers as required to optimize system performance. The amplifiers shall provide a minimum of 100 watts of power each. Amplifiers shall automatically transfer to battery when power fails or is disconnected. The amplifier shall have LED’s indicating “AC power fail” and “Battery trouble”. Sufficient amplifier power shall be provided to furnish a minimum average of 2 watts of power to all connected speakers on each channel, and in all spaces, provide the code mandated 15Db above the prevailing equivalent sound level or 5Db above the maximum sound level whichever is louder. Sound levels as specified by the NFPA 72, chapter 10, A-10-4.6.2 shall be furnished throughout. Amplifiers shall be protected by a back up amplifier capable of assuming the load of a failed amplifier automatically.

14. An audio control module shall be supplied as the master control module for all voice related functions. The audio control module shall communicate with the fire alarm master via high speed network communications lines.
a. A supervised tone generator capable of providing a variety of tones for use in the system shall be included within the capabilities of this module. Software configuration shall determine which tone the system uses. Minimum available signal configurations shall be:

1) Slow Whoop.
2) 900Hz Steady, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
3) Chime, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
4) Horn Steady, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
5) 2000Hz Steady, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-44.
6) Hi/Lo
7) Wail.

b. A backup tone card shall be furnished for the audio control module.

15. The master microphone module shall be permanently mounted behind the locked access door, visible through the viewing window and provide firefighters with the means of issuing voice message instructions to specific audio zones, groups of zones or all zones. The microphone and the press-to-talk switch shall be supervised. This module shall contain a local speaker with volume control to monitor selected audio channels.

16. The amplifier supervision modules shall supervise the output of all amplifiers, providing automatic switching of backup amplifier output when required.

17. Manual control and annunciator modules shall be provided on the face of the control panel in quantities required by the system. Module circuit labels shall be color coded to indicate speaker control, waterfall indication and valve supervision.

a. Furnish for the indication and control of all system speaker zones, modules comprised of eight software programmed switches, each capable of displaying status of the controlled zone via LED’s capable of displaying three different colors in both the steady and flashing state to denote the active status circuit and indicate trouble. All switch activation and LED status indications shall be software mapped to any system functions desired. Systems requiring the use of multiple switches to activate groups of zones or functions shall not be acceptable.

1) Speakers shall be located where indicated on plans.
2) Strobe visual signals shall operate in conjunction with the automatic activation of the speaker zones. Visual signals shall be programmable to remain activated until system reset or system acknowledgment, as required.

b. Furnish for the display of fire sprinkler system status, annunciator modules comprised of eight software programmed switches, each capable of displaying status of the controlled zone via LED’s capable of displaying three different colors in both the steady and flashing state to denote the status and indicate trouble, shall be provided in quantities as required to indicate real time status of each system waterfall switch and valve supervisory switch.

18. Provide as required, speaker/strobe zone modules providing 8 zones Style Y for either supervised speaker circuits or 24 VDC strobe light or combination of the two indicating type signals. Modules shall incorporate solid state self-restoring current limiting. Equipment requiring fuse replacement, manual resetting, or card replacement will not be considered acceptable.

19. The enclosure for the system shall provide complete dead front construction when the outer cabinet door is opened, with no wiring, terminals, batteries or electronic components visible. Human interface modules shall be on a frame hinge mounted to provide easy access to wiring.
and system plug in cards. Enclosure door shall be pin hinged and removable, for easy system operation by firefighters and technicians in testing and maintenance modes.

20. The system shall include a real time link to the system database, historical event log, logic, and operating system. The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. Systems requiring battery backed-up memory devices shall not be acceptable.

21. System display consisting of an 80 character back lit alpha numeric super twist LCD display readable at any angle. Thirty-two character customer defined custom messages shall describe the location of the active device.
   a. The system shall be capable of programming to allow troubles occurring and restored in the system to be automatically removed from the display queue, eliminating the necessity for individual acknowledging of these events. This feature shall not affect the historical logging of events as programmed.
   b. As a minimum, an LED display for "ALARM", "AUDIBLES SILENCED", "SUPERVISORY", "TROUBLE", "SECURITY", "POWER ON" and "PARTIAL SYSTEM DISABLED".
   c. Touch activated membrane switches for "ALARM ACKNOWLEDGE", "AUDIBLE SILENCE", "SUPERVISORY ACKNOWLEDGE", "TROUBLE ACKNOWLEDGE", "SECURITY ACKNOWLEDGE", "RESET", "DISPLAY HOLD" and "DISPLAY NEXT".
   d. All membrane switches shall be tactile with audible feedback when pressed.
   e. Touch activated membrane switches, programmable to perform a minimum of twelve custom designed and programmed functions such as drill, disable, bypass automatic control commands or other special functions as required by the system user. The membrane switches shall also be used for the entry of up to 128 individual pass codes, allowing for an individual code for each operator allowed to perform security bypass functions.
   f. Ten digit keypad for pass code entry to perform programming and maintenance functions.
   g. The system shall support a minimum of three supervised remote alpha numeric annunciators as full function remote control points. Each supervised annunciator shall support a printer.

22. Software defined logic module as required for each alarm initiation point, capable of controlling any combination of the system output functions using as logic factors; counting, verification, time, day, holiday, type of device, "and", "or", "not", "timer", "all", "any", flip-flop, D latch, and up to 32 levels of programming shall be possible.

23. Selective historical log, up to 800 events of all types, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports. Systems requiring segregated storage for classifications of event history shall be equipped with a hard drive storage device allowing the storage of a utility program for event sorting and a minimum of up to 800 events each for alarm, supervisory, status, security, trouble, operator actions and control outputs.
   a. The system shall allow selection of events to be logged, including inputs, as; alarms, troubles, supervisories, securities, status changes, walk tests and device verification, outputs as: audible control and output activation, actions as; reset, set sensitivity, arm/disarm, override, password, set time and acknowledge.
   b. Data format for downloading shall be compatible with the data base handling program, allowing custom report generation to track alarms, troubles and maintenance.
   c. Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 400 events will always be stored in non-volatile memory.
d. Downloading historical events shall set a system flag at the last event downloaded to allow future retrieval to start at that point, assuring a continuous history log.

24. Environment compensating, software driven logic for adjusting the alarm threshold windows on detectors to compensate for accumulating contamination and keep detector response sensitivity constant. The software shall compensate for either over-sensitized or de-sensitized units, raising a system flag when a detector approaches the allowable limits of adjustment, indicating a requirement for cleaning.
   a. Environment compensation values shall be stored in non-volatile memory allowing activation of all tracking functions within 90 seconds of system initiation from a “cold boot”. During the boot sequence, alarms from detectors programmed with the feature shall be suppressed. When the full data history is active all devices shall be checked and any active alarms displayed.
   b. The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty-four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state.
   c. The system shall be capable of monitoring the state of detectors and displaying a message when a detector is approaching the limits of adjustment as a result of contaminates. A second message shall be displayed when the detector reaches the limits of adjustment due to contaminates.
   d. The system shall recognize that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors’ normal sensitivity setting reference based on a new cumulative average.

2.2 FIRE ALARM SYSTEM POWER SUPPLIES

A. System primary power. Primary power for the FACP and the secondary power battery chargers shall each be obtained from the nearest 120V emergency panel. See plans for the exact location of the 120V power panel.

B. Secondary power supply. Provide sealed gelled electrolyte batteries as the secondary power supply for the fire alarm control panel and each system circuit interface panel. The battery supply shall be calculated to operate its load in a supervisory mode for twenty four hours with no primary power applied and, after that time, operate its alarm mode for two hours. Batteries shall be sized at no larger than 80% of the calculated size to compensate for deterioration and aging during the battery life cycle. Battery calculations shall be submitted to justify the battery size. Batteries shall be housed in the control cabinet or a separate cabinet with adequate cell separation to prevent accidental discharge.

2.3 SPARE BOX

A. Provide a separate box located adjacent to the main fire alarm panel. The box shall be sufficiently sized (16” X 16” C 6” minimum) to hold all spare detectors and paperwork. This box shall match the main fire alarm panel in appearance and be keyed the same.

2.4 REMOTE CIRCUIT INTERFACE PANELS

A. Remote circuit interface panels shall consist of an enclosure, a remote power supply, digital communications circuitry, mother boards, batteries and hardware, modules and circuitry described for inclusion in the fire alarm control panel as required to function as specified.

1. Circuit interface panels, when required, include conventional zone module, analog loop drivers, indicating appliance circuits, output circuitry to perform actions, speaker supervisory and distribution circuits. All fire detection, alarm and indicating devices supported by the circuit
interface panel shall function as a self standing system in the failsafe mode upon loss of the central fire alarm control panel processing, communications or the communications wiring between them.

2. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the default mode.

3. Circuit interface panels shall support remote system displays, annunciators and printers. Test procedures shall be capable of initiation at the main fire control panel, any remote LCD annunciator or any remote interface panel equipped with a keypad.

2.5 DETECTOR BASES

A. Detector Bases – Detector bases shall be low profile, surface or flush mounted in a standard 4” square by 2-1/8” deep box. Bases shall be able to accept photoelectric, ionization or heat detectors.

2.6 SMOKE DETECTORS-PHOTOELECTRIC

A. Furnish and install where indicated on the drawings, intelligent analog smoke detectors

1. Manufacturers:
   a. System Sensor, no exception, equipped as follows:
      i. have an LED that flashed during normal operation;
      ii. be self-adjusting for airborne contaminants;
      iii. have clear, distinct visual alarm indication;
      iv. be programmed to have alarm verification.

2.7 DUCT DETECTORS-PHOTOELECTRIC

A. Furnish and install where indicated on the drawings, intelligent analog smoke detectors

1. Manufacturers:
   a. System Sensor, no exception. Detectors shall be campus standard System Sensor equipped as follows:
      i. have clear, distinct visual power and alarm indications;
      ii. be programmed to have alarm verification;
      iii. if mounted where not readily accessible or not within normal view, have extended visual indicators and capability of re-setting the duct detector.

2.8 HEAT DETECTORS, INTELLIGENT RATE COMPENSATED

A. Furnish and install where indicated on the drawings, intelligent analog smoke detectors

1. Manufacturers:
   a. System Sensor, no exception. Detectors shall be campus standard System Sensor equipped as follows:
      i. shall be of the dual element, self-restoring type;
      ii. have a flashing LED for normal operation;
      iii. have clear, distinct alarm visual indication.

2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet for use in environments as covered by Factory Mutual and UL (UQGS) and shall be installed according to the requirements of NFPA 72E for open area coverage.

2.9 MANUAL STATIONS, INTELLIGENT

A. Provide single action intelligent manual stations where shown on the drawings, to be flush or surface mounted as required.

1. Shall be high impact plastic, red in color.
2. Provide a clear indication when activated.
3. Station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring.
4. The manual stations shall be addressable and identifiable by the master fire alarm control panel. Address assignments shall be set electronically and reside within the station in non-volatile memory. Devices using rotary switches, pins, jumpers or staples are not acceptable.
5. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer’s prescribed matching baked red enamel outlet box.

2.10 MAGNETIC HOLD OPEN DEVICE
A. Provide 120VAC magnetic hold open devices where indicated in architectural door hardware specification and where required by Code. Devices shall close on an alarm.

2.11 INTELLIGENT SYSTEM INTERFACE MODULE
A. Furnish and install, for the monitoring of contact type initiation devices and for the control of electrical devices where required, intelligent analog signaling circuit interface module. Modules shall be supplied to meet the project requirements as follows:
   1. A single circuit intelligent signaling circuit interface module for monitoring alarm, trouble, supervisory security or status contact type devices.
   2. Unit as above with form C software programmable control contacts for the management of specified electrical loads as required by this specification.
B. The module shall be addressed, tested and programmed prior to installation using a UL listed programmer/tester.
C. The module shall be suitable for two wire, two way communications on the intelligent analog signaling circuit. The module shall display a steady LED for each circuit, in the normal power or standby power condition, when in the alarm state or during control circuit activation.
D. Modules shall incorporate triple technology microprocessor chips including analog, digital and EEROM technologies on the single device. Address assignments shall be set electronically and devices requiring dip switches, rotary switches, staples or jumpers are not acceptable.

2.12 FIRE SPRINKLER SYSTEM DETECTION AND SUPERVISION
A. Furnish sensors for installation by the fire sprinkler system contractor and provide system interconnection for the following functions. See plumbing plans for requirements.
   1. Waterflow switches, vane type, with adjustable pneumatic retard of 0 - 75 seconds, single pole double throw switch calibrated for actuation when flow rate equals 10 GPM or greater.
   2. Outside screw and yoke valve supervisory switches in sizes as required for monitoring valves as indicated on the drawings. The single pole double throw supervisory switch shall activate an off normal report within one half turn of the valve.

2.13 INTELLIGENT SUPERVISED CONTROL MODULE
A. Furnish and install for the control of supervised relays, contactors, audible signal circuits, visual signal circuits, distributed speaker circuits and two way fire fighters communication circuits, intelligent supervisory and control modules including features as follows:
   1. The modules shall be suitable for two wire operation and communications on intelligent analog alarm detection loops. Address assignments shall be accomplished electronically. Devices requiring dip switches, rotary switches, staples and/or jumpers are not acceptable.
   2. The module shall display a steady LED in the normal power or standby power condition, when in the activated state.
3. The module shall be suitable for semi-flush or surface mounting in a 2” deep, 4” square or double gang electrical outlet box having a depth of 3 1/2”.

B. Modules shall be available to supervise reverse polarity supervised indicating circuits utilizing 24VDC, two way supervised fireman’s communication circuits or audio circuits utilizing 25VRMS or 70.7VRMS. It shall be possible to configure the module for control of motor contactors and AC voltages to 115VAC.

1. All connected field wiring shall be supervised for opens, short circuits and grounded circuits.
2. All controlled circuits shall be power limited at 1.5A, produced by self-restoring thermal components. Units requiring circuit replacement for restoration of outputs are not acceptable.
   a. Signal outputs shall be supported in either Style “Y” or Style “Z” configuration.
   b. The module shall report a trouble condition in the event of loss of the 24VDC signal operating supply voltage.

2.14 EVACUATION SIGNALS

A. Speakers: Shall be of the polarized 24-Vdc type. Speaker shall be UL listed for fire alarm voice evacuation use. Speakers shall be designed to be mounted on a wall, ceiling or other suitable rigid surface and shall be capable of being surface, semi flush, or flush mounted. Speakers shall be multi-tap. Settings shall be 1/16, 1/8, 1/4, 1/2, 1, 2 or 4 watts.

B. Strobe Light: ADA visual notification appliances shall be compromised of a xenon flashtube and be entirely solid state. These devices shall be UL listed and be capable of either ceiling or wall mounting. Provide a unit that is ADA compliant with an output no less than 15 candela. The Lexan lens shall be pyramidal in shape to allow better visibility. Provide a red lens on selected strobes where indicated on plans. Strobe light candela ratings have been shown on the plans. However, contractor is responsible for sizing strobes per NFPA 72 based on room size and device location. Units shall be installed 80” above finished floor. All strobes within the same line of site shall be synchronized. Candela ratings have been shown on the plans. These ratings shall be verified based on the room size and NFPA requirements. Where there are discrepancies The NFPA requirements for candela rating shall take precedence over the values shown on the plans. Provide multi-tap strobes to allow for a full range of candela settings. Settings shall be 15/75, 30/75, 75 or 110 candela. Circuits for strobes shall allow for capacity to increase strobe intensities one setting for all strobes. Provide spare devices equal to 1% of the total number of new devices provided for this project.

C. Speaker/Strobe combination: Standard, ADA Audio/Visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate either horns, bells, chimes or speakers. The unit shall be complete with a tamper resistant, Pyramidal shaped lexan lens with Fire lettering visible from a 180-degree field of view. The front panel or bezel that is constructed of UL Listed Noryl, may be inverted so that the lens is below the audible device. Integral Xenon strobe shall provide 8000 peak candlepower and be adjustable from 1 to 3 flashes per second. Provide a unit approved for ADA compliance. Strobe shall be multi-tap type to allow for a full range of candela settings as indicated in paragraph G. Xenon strobe shall provide 4-wire connection to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox. Audio/visual unit shall be UL listed for its intended purpose. Speaker shall be multi-tap type to allow for different audio settings as indicated in paragraph F. Provide spare devices equal to 1% of the total number of new devices provided for this project.

D. The evacuation signals shall be available in flush, semi-flush, or surface versions as required for signal locations shown on the contract documents. Signals shall be mounted using a listed outlet box, and as required, tile bridges. Signals shall be available in visual only and combination to satisfy all required project applications. Visual only and combination audio/visual alarms shall be white with red “FIRE” lettering.
2.15 SECURITY INTERFACE TERMINAL BOX

A. The interface terminal box shall be a lockable continuous hinge cover NEMA Type 4 enclosure. The cover of the enclosure shall be labeled to identify its function.

B. Dual screw barrier type terminal strips shall be provided within the interface terminal box. Terminals shall be provided for each interface output from the fire alarm system and the manual unlock keyswitch. All terminals shall be labeled to identify their function.

C. The output contacts from the fire alarm system shall be rated for 1A at 120V.

PART 3 - EXECUTION

3.1 DESIGN AND INSTALLATION DRAWINGS

A. Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility with all other systems interfacing with the fire alarm system.

1. Identify on the drawings, conduit and conductor sizes and types with number of conductors in each conduit. Provide each conduit and device with a unique identification. For addressable alarm initiation devices, the system identifier shall be the system address for that device. Signals shall be sequentially numbered as the address of the controlling module.

2. Indicate on the point to point wiring diagrams, interconnecting wiring within the panel between modules, and connecting wiring to the field device terminals.

3. Provide mounting details of FACP and other boxes to building structure, showing fastener type, sizes, material and embedded depth where applicable.

3.2 INSTALLATION

A. Perform work in accordance with the requirements of NEC, NFPA 70, and NFPA 72.

B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

1. Use clamping devices for attaching to structural steel, or when clamping is impractical, obtain written authority to weld or to drill.

2. Fasten equipment to concrete or masonry with expansion anchors.

3. Fasten equipment to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-taping metal screws.

4. Do not install conduit raceways and boxes in positions that interfere with the work of other trades.

5. Attach nameplates on panels or other components as specified.

3.3 CONDUIT

A. All wiring shall be installed in conduit, minimum ¾” EMT. Plenum rated cable with J-hooks may be used above ceilings.

3.4 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.

1. Extension rings with blank covers shall be installed on junction boxes where required.

2. Junction boxes served by concealed conduit shall be flush mounted.
3. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
4. “Fire alarm system” decal or silk-screened label shall be applied to all junction box covers. All boxes shall be red.

3.5 CONDUCTORS
A. Each conductor shall be identified as shown on the shop drawings with wire markers at every splice and terminal point. Attach permanent wire markers within 2 inches of each wire termination. Marker legends shall be visible.
  1. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
  2. Wiring for analog loop circuits and speaker circuits shall be 18 AWG twisted. Wiring for strobe circuits shall be a minimum 14 AWG.
  3. Splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer's recommendations.
  4. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
C. Provide Type CI, 2 hour rated circuit integrity cable for riser wiring and wherever else required per code.

3.6 CERTIFICATE OF COMPLIANCE
A. Complete and submit to the Owner in accordance with NFPA 72.

3.7 FIELD QUALITY CONTROL
A. Testing, General.
  1. All intelligent analog devices shall be tested and logged for correct address and sensitivity using test equipment specifically designed for that purpose. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the system address, initials of the installing technician and date.
  2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
    a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
    b. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector, shall be corrected.
    c. Test reports shall be delivered to the acceptance inspector as completed.
  3. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
    a. Ladders and scaffolds as required to access all installed equipment.
    b. Multimeter for reading voltage, current and resistance.
    c. Intelligent device programmer/tester.
d. Laptop computer with programming software for any required program revisions.
e. Two way radios, flashlights, smoke generation devices and supplies.
f. Spare printer paper.
g. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.
h. Decibel meter.

4. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

5. System wiring: fire alarm circuits shall be tested for continuity, grounds, and short circuits.

B. Acceptance testing.

1. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the Acceptance Inspector in accordance with NFPA 72, and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

2. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input. In the case of outputs programmed using more complex logic functions involving “any”, “or”, “not”, “count”, “time”, and “timer” statements; the complete output equation shall be referenced in the matrix.

3. A complete listing of all device labels for alpha numeric annunciator displays and logging printers shall be prepared by the installing contractor prior to the ATP.

4. The acceptance inspector shall use the system record drawings in combination with the documents specified under Paragraph 3.1 during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:

a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
   1) Open, shorted and grounded intelligent analog signaling circuit.
   2) Open, shorted and grounded network signaling circuit.
   3) Open, shorted and grounded conventional zone circuits.
   4) Open, shorted and grounded speaker, telephone circuits.
   5) Intelligent device removal.
   6) Primary power or battery disconnected.
   7) Incorrect device at address.
   8) Printer trouble, off line or out of paper.

b. System evacuation alarm indicating appliances shall be demonstrated as follows:
   1) All alarm notification appliances actuate as programmed
   2) Audibility and visibility at required levels.

c. System indications shall be demonstrated as follows:
   1) Correct message display for each alarm input at the control panel, each remote alphanumeric display and each CRT terminal.
   2) Correct annunciator light for each alarm input at each annunciator and color graphic terminal as shown on the drawings.
   3) Correct printer logging for all system activity.

d. Secondary power capabilities shall be demonstrated as follows:
   1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
2) System primary power shall be restored for forty-eight hours and system charging current shall be normal trickle charge for a fully charged battery bank.

3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.

5. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
   a. The installing contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
   b. In the event that software changes are required during the ATP, a utility program shall be furnished by the system manufacturer to compare the edited program with the original. This utility shall yield a printed list of the changes and all system functions, inputs and outputs effected by the changes. The items listed by this program shall be the minimum acceptable to be re-tested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.
   c. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete re-testing.

3.8 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following:
   1. System record drawings and wiring details including one set of reproducible masters and drawings on 3-1/2 inch floppy disks or CD ROM in a DXF format suitable for use in a CAD drafting program.
   2. System operation, installation and maintenance manuals
   3. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
   4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
   5. System program showing system functions, controls and labeling of equipment and devices. Also provide a 3.5" floppy or CD ROM diskette with system file.

3.9 TEST EQUIPMENT

A. Refer to Division 01 91 13 for General commissioning requirements.

B. The Contractor shall furnish all test equipment as required to program devices and test the system, specifically an intelligent device tester and programmer.

3.10 INTERFACE TERMINAL BOX

A. The fire alarm system contractor shall install the interface terminal box at the main fire alarm control panel in a readily accessible location no more than 8'-0" A.F.F.

B. The fire alarm contractor shall wire from the fire alarm system to the interface terminal box.

C. The security contractor shall wire from the security system to the interface terminal box.

3.11 INTERFACE CONDUIT, POWER AND WIRING

A. The fire alarm contractor shall provide all conduit, power and wiring required for the installation of the terminal box, manual unlock switch and interfacing to the fire alarm system. All wiring shall be UL listed for the fire alarm applications.
B. The security contractor shall provide all wiring from the interface terminal box to the security system. All wiring shall be UL listed for fire alarm applications.

3.12 WARRANTY AND SERVICES

A. The contractor shall warrant the entire system against mechanical and electrical defects for a period of 18 months. This period shall begin upon completed certification and test of the system.

B. During the warranty period, the fire alarm system subcontractor or manufacturer shall provide at no additional charge the inspection, parts, maintenance, testing and repair in full compliance with the requirements of NFPA 72.

C. The installation contractor shall furnish training as follows for a minimum of four employees of the system user:
   1. Training in the receipt, handling and acknowledgement of alarms.
   2. Training in the system operation including manual control of output functions from the system control panel.
   3. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.
   4. The total training requirement shall be a minimum of 6 hours but shall be sufficient to cover all items specified.

END OF SECTION
UNIVERSITY OF NORTH TEXAS DENTON - RETAIL

ISSUE FOR CONSTRUCTION

5 APR 2021
| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |

**ABBREVIATIONS**

- FA: FIRE ALARM
- FC: FIRE CODE
- FD: FLOOR DRAIN
- FE: FIRE EXTINGUISHER
- FEB: FIRE EXTINGUISHER, BRACKET
- FEC: FIRE EXTINGUISHER, CABINET
- OFC: OWNER FURNISHED/CURRICULUM
- ACM: ALUMINUM COMPOSITE METAL
- OCG: OVERHEAD COILING GRILLES
- OFCI: OWNER FURNISHED/INSTRUMENTATION
- ADJ: ADJACENT
- OFO: OWNER FURNISHED/OPERATION
- AVG: AVERAGE
- OF/M: OFFICE/MAIL
- A/C: AIR CONDITIONING
- OF/O: OWNER FURNISHED/RESERVATION
- AMP: AMPERES
- OFP: OWNER FURNISHED/PNEUMATIC
- ANOD: ANODIZED
- OFW: OWNER FURNISHED/WATER
- ANS: ANCHOR SQUARE
- OFX: OWNER FURNISHED/EXPANSION
- ANV: ANVIL
- OFY: OWNER FURNISHED/YES
- AP: APPLIANCE
- OFZ: OWNER FURNISHED/ZEN
- APN: APPEARANCE
- O/F: OUTSIDE AIR
- ARE: AREA
- O/F: OUTSIDE FLOOR
- ARG: ALUMINUM RADIUM
- O/F: OUTSIDE frame
- ARG: ALUMINUM RADIUM
- O/F: OUTSIDE frame
- ARG: ALUMINUM RADIUM
- O/F: OUTSIDE frame
- ARG: ALUMINUM RADIUM
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**DIVISION 3 CONCRETE**

**050510  METAL FINISHES**

**MF-1 Metal Anodized Aluminum**

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**DIVISION 4 MASONRY**

**095426 SUSPENDED WOOD CEILING SYSTEMS**

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**DIVISION 5 METALS**

**16 GA**

- Color: Black
- Thickness: 0.0625" (16 GA)

**DEKTON**

- Color: Black

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**DIVISION 6 WOOD AND COMPOSITES**

**083113  ACCESS DOORS**

- Type: Non-Rated: Access Door in Wall (Flange)
- Manufacturer: Schluter Systems - Jolly

**DIVISION 26 ELECTRICAL**

**SS-1**

- Type: Porcelain Bone
- Color: White

**DIVISION 30 FIRE PROTECTION**

**MG-1**

- Type: Fire Sprinkler
- Color: Red

**DIVISION 31 PLUMBING**

**PB-1**

- Type: Toilet
- Color: White

**DIVISION 34 HEATING, VENTILATING AND AIR CONDITIONING**

**AC-1**

- Type: Central Air
- Color: White

**DIVISION 35 ARCHITECTURAL SIGNS AND DECORATIVE ITEMS**

**DA-1**

- Type: Sign Board
- Color: Black

**DIVISION 36 ACOUSTICAL PANEL Ceilings**

**AC-2**

- Type: Acoustic Panel
- Color: White

**DIVISION 37 ARCHITECTURAL METAL**

**AM-1**

- Type: Metal Panel
- Color: Black

**DIVISION 38 LIGHTING**

**EL-1**

- Type: Light Fixture
- Color: White
These drawings have been prepared as one coordinated set of drawings and are complimentary. What is required by one drawing is required by all of the drawings, even if a detail or information is presented only on a single or select few sheet(s) of the drawings will be at the user's sole risk and shall not form the basis for a request for additional compensation or time.
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- Sheet A1 2
- Sheet A1 3

These sheets should be referred to for specific information.

PRECAUTIONARY NOTES:

1. IF THE PARTITION LAYOUT IS SHORT RUNS WITH SUBSTANTIAL BRACING CONDITIONS EVERY 8'-0" O.C., THE STEEL TUBES MAY NOT BE REQUIRED.
2. IF THE PARTITION LAYOUT HAS SUBSTANTIAL BRACING @ 8'-0" O.C., IT WOULD BE PRUDENT TO USE 20 GA. METAL FRAMING INSTEAD OF THE TYPICAL 25 GA. METAL FRAMING.
3. THIS DETAIL IS DESIGNED TO BE USED AS A DIVIDER PARTITION ONLY AND NOT AS A GUARDRAIL ELEMENT. DETAIL IS BASED ON 5 LBS PER SQUARE FOOT LOAD AND NOT A CONCENTRATED 200 LB. LIVE LOADS AS REQUIRED FOR GUARDRAILS.

SCHEDULE WALL BASE

- 3/16" X 2 1/2" STRUCT. STEEL TUBE FULLY WELDED TO 5/8" THICK X 3 1/2" X 7 1/2" STEEL BASE PLATE, SECURED TO CONCRETE SLAB WITH 5/8" DIA. 4" EMBED HILTI KWIK BOLT II EXPANSION ANCHOR BOLTS.
- STEEL TUBES SET @48" O.C. MAXIMUM SPACING.

SECTION

- 1 1/2" X 2 1/2" CONT. FIRE RETARDANT TREATED WOOD BLOCKING
- 2 1/2" - 20 GA. HEAD TRACK, 2 1/2" METAL STUDS@18" O.C. NOT SHOWN IN PLAN VIEW TO ALLOW CLEAR VIEW OF BASE PLATE

STUD

- LIMITING HEIGHT
- ACOUSTIC
- INSULATION STC WALL BOTTOM
- UL LISTING

FIRE

- TYPE
- RATING
- GAUGE
- SPACING

STUD

- LIMITING HEIGHT
- ACOUSTIC
- INSULATION STC WALL HEAD
- UL LISTING

FLOOR

- TYPE
- RATING
- GAUGE
- SPACING

SILL

- TYPE
- RATING
- GAUGE
- SPACING

HABITATION DIVIDER PARTITION

- 5/8" GYP. BD. EA. SIDE WITH SCHEDULED FINISH
- METAL CORNER BEAD & FLOAT EACH SIDE
- ALIGN
- 1" TYP."
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TILE - 9 ON 1/2" CEMENT BOARD SUBSTRATE ATTACHED TO METAL STUDS

1 1/2" BLACK ALUM PERIMETER TUBE BEYOND STAINLESS STEEL EQUIPMENT ATTACHED TO METAL STUD WALL; REFER TO MASTER SCHEDULE MF-2

NOTE: SERVERY MILLWORK DETAILS ARE FOR FINISHES/DIMENSIONS ONLY, REFER TO FOOD SERVICE DRAWINGS, MEP, & TELECOM/DATA DOCS FOR ADDITIONAL INFORMATION

PROVIDE AND COORDINATE LOCATION OF GROMMETS FOR EQUIPMENT, REFER TO FOOD SERVICE DOCS

PROVIDE 6" DIAMETER COUNTER OPENING WITH SS-1 RETURN

PROVIDE BLOCKING FOR METAL FRAMING BY FOOD SERVICE EQUIPMENT INSTALLER, SHOWN DASHED

NOTE: SERVERY MILLWORK DETAILS ARE FOR FINISHES/DIMENSIONS ONLY, REFER TO FOOD SERVICE DRAWINGS, MEP, & TELECOM/DATA DOCS FOR ADDITIONAL INFORMATION

STAINLESS STEEL BASE WITH 1/2" CEMENT BOARD INSERT FOR TILE - 9 ON FIXED SHELVING

PROVIDE OPENING FOR POWER INFRASTRUCTURE; REFER TO FOOD SERVICE, MEP, TELECOM/DATA DOCS

FUTURE 3" LIT GRAPHIC BOX

NOTE: SERVERY MILLWORK DETAILS ARE FOR FINISHES/DIMENSIONS ONLY, REFER TO FOOD SERVICE DRAWINGS, MEP, & TELECOM/DATA DOCS FOR ADDITIONAL INFORMATION

POWER FOR FUTURE LIT GRAPHIC BOX; EQUIPMENT PLATES TO HAVE A BLACK FINISH

3/4" SUBSTRATE ATTACHED TO SS-1 RETURN

VERTICAL 1" BLACK ALUM TUBE ATTACHED TO STUD WALL; REFER TO MASTER SCHEDULE MF-2

TYP. PT-1 U.N.O. PTD 5/8" GYP BD, SCHED LIGHT FIXTURE

MF-2 SCHEDULED WOOD CEILING SYSTEM-095426 LMC-1

T-2

T-9

T-2

T-9

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STUDENT OF THE UNIVERSITY OF TEXAS OF THE PLEDGING DENTON - RETAIL

NOTE: SERVERY MILLWORK DETAILS ARE FOR FINISHES/DIMENSIONS ONLY, REFER TO FOOD SERVICE DRAWINGS, MEP, & TELECOM/DATA DOCS FOR ADDITIONAL INFORMATION

REGIS TED ARCHITECT
STATE OF TEXAS
STEPHENV. DURHAM
15134
28 APRIL 2021
A. The structure and structural components of the building have been designed in accordance with the American Institute of Steel Construction (AISC) 2016, AISC Load and Resistance Factor Design (LRFD) Specification, AISC 360-16, Standard for Structural Steel Buildings, and AISC 341-16, Seismic Provisions for Structural Steel Buildings. The structural steel for the building shall be fabricated and erected as specified in the drawings and specifications.

B. The structural design of the building includes the design of the structural steel, concrete, and masonry elements. The design is based on the loads and conditions specified in the drawings and specifications. The design includes the determination of the loads, the design of the structural elements, and the detailing of the connections. The design is verified by the performance of the contractor, and the quality of the materials used. The design is reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.

C. The structural design includes the determination of the loads, the design of the structural elements, and the detailing of the connections. The design is verified by the performance of the contractor, and the quality of the materials used. The design is reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


E. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


G. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


I. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


K. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


M. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


O. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


Q. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


S. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


U. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


W. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.


Y. The structural steel members shall be designed for the loads specified in the drawings and specifications. The design shall be verified by the performance of the contractor, and the quality of the materials used. The design shall be reviewed by the structural engineer, and the contractor is responsible for the proper installation of the structural elements.

Where structural load-bearing members and assemblies are shop fabricated, the Special Inspector shall verify that the fabricator:

**1. SPECIAL INSPECTIONS**

- When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 in. (75 mm) of the weld.

**REQUIRED**

The Contractor shall coordinate with and notify the Special Inspector of all tests. The Special Inspector shall be responsible to the fabricator's ability to conform to the Construction Documents and Referenced Standards, unless the fabricator is registered.

**2. INSPECTION FREQUENCY**

- Arc strikes: X
- Backing removed and weld tabs removed (if required): X
- Use of qualified welders: X
- Manufacturer certifications for welding consumables available: X
- WPS followed: X
- Interpass and final cleaning: X
- Joint preparation: X
- Proper position (F, V, H, OH): X
- Weld profiles:
  - Travel speed:
  - Welding current:
  - Welding voltage:
  - Amperage:
  - Duty cycle:
- Interpass temperature maintained (min./max.):
- Preheat applied: X
- Each pass within profile limitations: X
- Each pass meets quality requirements: X
- 7) Proper position (F, V, H, OH)
- 6) Undercut
- 5) Preheat applied
- 4) Root reinforcement
- 3) Each pass meets quality requirements
- 2) Each pass within profile limitations
- 1) Interpass and final cleaning
- 1) Crack prohibition
- 3) Crater cross section
- 2) Crack prohibition
- 1) Crack prohibition

**3. PERIODIC**

- X -- Yes
- -- -- No

**REFRENCE**

- AISC 360-10
- AWS D1.1
- AWS D1.4
- ASTM C31
- ACI 318:
  - 1705.2.1
  - 26.9.2.1
  - 26.9.2.3
  - 26.4.5
  - 17.8.2
  - 17.8.2.2
  - 17.8.2.3
- 26.10.2
- 26.5.1-2
- 26.5.3
- 1904.1, 1904.2
- 1908.2, 1908.3
- 1908.7, 1908.12
- 1705.2.1
- 26.10.2
- 26.5.1-2
- 26.5.3

**INSPECTION TASKS FOR BOLTING STRUCTURAL STEEL (AISC 360-10 Tables N5.6)**

1. Inspection tasks prior to bolting:

- a. Verify weldability of reinforcing bars other than ASTM A706 incl. inclined orientations to resist sustained tension loads.
- b. Proper storage provided for bolts, nuts, washers and other hardware.
- c. Fastener component not turned by the wrench.
- d. Fasteners are pretensioned in accordance with the Installation Instructions per ACI 318.
- e. Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet designs requirements.
- f. Bolts installed within tolerance limits based on hole and member tolerances.
- g. Proper torqueing system used.

2. Inspection tasks prior to welding:

- a. Use of qualified welders.
- b. Manufacturer certifications for welding consumables available.
- c. WPS followed.
- d. Arc strikes.
- e. Cracks prohibited.
- f. Interior and exterior cleaning.
- g. Use of qualified welders.
- h. Proper storage provided for bolts, nuts, washers and other hardware.
- i. Fastener component not turned by the wrench.
- j. Proper torqueing system used.

**9. Inspection of prestressed concrete:**

- 1. Verify in-situ concrete strength, prior to stressing.
- 2. Verify use of required design mix.
- 3. Inspect erection of precast concrete members.
- 4. Inspect post-installed anchors in hardened concrete.
- 5. Inspect reinforcing steel, including prestressing connections.
- 6. Inspect use of required prestress anchors and anchorage system.
- 7. Verify in-situ concrete strength prior to stressing.
- 8. Verify use of required design mix.
- 9. Inspect erection of precast concrete members.
- 10. Inspect post-installed anchors in hardened concrete.
- 11. Inspect reinforcing steel, including prestressing connections.
- 12. Inspect use of required prestress anchors and anchorage system.

**10. Inspect use of required design mix.**

- a. Concretes are mixed in accordance with the approved mixes.
- b. The use of admixtures is in accordance with the approved mixes.
- c. The concrete slump and air content are as specified.
- d. The concrete is placed and compacted in accordance with the approved mixes.
- e. The concrete is cured in accordance with the approved mixes.

**11. Inspect use of required prestress anchors and anchorage system.**

- a. The use of prestress anchors and anchorage systems is in accordance with the approved mixes.
- b. The concrete is cured in accordance with the approved mixes.
- c. The concrete is placed and compacted in accordance with the approved mixes.
- d. The concrete is cured in accordance with the approved mixes.
- e. The concrete is placed and compacted in accordance with the approved mixes.
- f. The concrete is cured in accordance with the approved mixes.
- g. The concrete is placed and compacted in accordance with the approved mixes.
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- i. The concrete is placed and compacted in accordance with the approved mixes.
- j. The concrete is cured in accordance with the approved mixes.
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1 LOW ROOF FRAMING PLAN

2 FOUNDATION SLAB PLAN

3 SECTION

Notes:
1. ALL EXISTING DIMENSIONS AND STEEL ELEVATIONS SHALL BE FIELD VERIFIED BY G.C. - TYP.
2. ALL EXISTING DIMENSIONS SHALL BE FIELD VERIFIED BY G.C. - TYP.
3. G.C. TO VERIFY W/ JOIST MFR. IF ADDN'L JOIST REINFORCEMENT IS REQ'D FOR THE EXIST.
4. G.C. TO FIELD VERIFY.
5. SEE PLAN NOTE 3

SCALE: 3/4" = 1'-0"

FOUNDATION SLAB PLAN

1 1/2" CLR.

LOW ROOF FRAMING PLAN

SCALE: 1/8" = 1'-0"
5 JOG DUCT UP/DOWN AS REQUIRED TO COORDINATE WITH CROSSING DUCTWORK.

EXISTING THERMOSTAT IS MOUNTED TO EXISTING VAV BOX PER SHELL DRAWINGS.

NO DUCT OR PIPING ALLOWED OVER ELECTRICAL EQUIPMENT PER CODE. SHELL DESIGN INTENT FOR DIFFUSERS IS TO COORDINATE WITH WOOD CLOUD CEILINGS SO SPACE HAS SIGNIFICANT AMOUNT OF HYDRONIC AND DOMESTIC PIPING OVERHEAD.

RELOCATE EXISTING TENANT VAV BOX TO HIGH CEILING TO MAINTAIN CODE REQUIREMENTS.

FINISH IN THIS AREA IS INTENDED TO BE BLACK. PROVIDE DIFFUSERS WITH BLACK PAINT FINISH AND PROVIDE PAINTABLE DUCT INSULATION. (TYP.) CONFIRM PAINT SCHEDULE.

MODIFY EXISTING VRH CONTROLS TO MATCH DESIGN AIRFLOWS. (TYP.) WIRE AS NEEDED. IF THERMOSTAT RESTS ON EXPOSED COLUMN, PROVIDE DRAINAGE.

RE-LOCATE THERMOSTAT TO LOCATION SHOWN. EXTEND CONDUIT AND CONTROL ARCHITECTURAL RCP FOR MORE INFORMATION.

EXISTING DUCT AND/OR PIPING THAT CROSSES OVER ELECTRICAL EQUIPMENT (TYP.) PROVIDE DRIP PAN, WITH LEAK DETECTION TIED TO BMS, UNDERNEATH ALL NEW AND PRE-EXISTING PIPING.

SPACE HAS SIGNIFICANT AMOUNT OF HYDRONIC AND DOMESTIC PIPING OVERHEAD.

THAT AIRFLOW IS NOT BLOCKED. (TYPICAL FOR ALL DIFFUSERS). REFER TO SHELL DRAWINGS.

RELOCATE EXISTING DUCTWORK TO HIGH CEILING TO MAINTAIN CODE REQUIREMENTS. PATCH, INSULATE, AND PROVIDE AIR-TIGHT SEAL ON DUCT OPENING NO LONGER USED.

RELOCATE EXISTING TENANT VAV BOX TO HIGH CEILING TO MAINTAIN CODE REQUIREMENTS.

EXISTING DUCT AND/OR PIPING THAT CROSSES OVER ELECTRICAL EQUIPMENT (TYP.) PROVIDE DRIP PAN, WITH LEAK DETECTION TIED TO BMS, UNDERNEATH ALL NEW AND PRE-EXISTING PIPING.

THAT AIRFLOW IS NOT BLOCKED. (TYPICAL FOR ALL DIFFUSERS). REFER TO SHELL DRAWINGS.

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RELOCATE EXISTING DUCTWORK TO HIGH CEILING TO MAINTAIN CODE REQUIREMENTS. PATCH, INSULATE, AND PROVIDE AIR-TIGHT SEAL ON DUCT OPENING NO LONGER USED.
**3.2 SYSTEM OPERATION**

- **Off Mode**
  - System continuously monitors exhaust airflow at each hood and generates a signal 0 to 10 V proportional to total airflow Reporting and Replacement Air Control.

- **Fire Mode**
  - Used to override pre-programmed operation. Air flow in the hood is maintained for a predetermined cooking time before returning to the Idle mode.

- **Shutdown**
  - System moves into cooking mode when an infrared sensor detects cooking activities under the hood.

- **Cooking Mode**
  - After idle mode, enters Active mode.
  - Minimal exhaust flow captures any appliance-generated heat. Default is 40% of design airflow or as adjusted to meet requirements.
  - Pending until signs of cooking activity sensed from infrared sensor(s).

- **Idle Mode**
  - Startup
    - Can be started by:
      - The building management system or via an internet connection remotely.
      - Press and hold for 1 second to accelerate the exhaust rate to 100% of the design airflow for a predetermined period of time (default 1 hour.) Starts the hood if it has been overridden by a schedule or an event.
      - Two modes:
        - 'Off' state.
        - 'Stand-alone' and 'Separate from the base building Captive Aire System.'

**3.1 DESIGN AND LAYOUT**

- PART - EXECUTION

  - System continuously monitors exhaust airflow at each hood and generates a signal 0 to 10 V proportional to total airflow Reporting and Replacement Air Control.

- PART 2 - PRODUCTS

  - 1.1 SCOPE OF WORK

  - 1.2 ENGINEER TO OPERATE IN ACCORDANCE WITH THE NEW OR EXISTING MAIN CONTROL PANEL AND NEW/EXISTING SEQUENCES OF OPERATION ON THE DRAWINGS.

- SECTION 230900 - CONTROLS

  - A. THE CONTROL SYSTEM DESIGN AND LAYOUT SHALL BE PERFORMED BY A FACTORY CONTRACTOR FOR FULL BACNET POINTS LIST FOR BAS INTEGRATION.
  - B. PROVIDE ALL WIRING REQUIRED TO CONNECT INPUT/OUTPUT DEVICES TO CONTROL PANEL AND NEW/EXISTING SEQUENCES OF OPERATION ON THE DRAWINGS.
  - C. TEST AND ADJUST ALL DEVICES AND DOCUMENT CALIBRATION.
  - D. PROVIDE NECESSARY INSTRUCTION TO THE OWNER'S PERSONNEL.

- **DCV Kitchen MAU and KEF Controls (TYPICAL OF EACH)**

  - Data provided in the BACnet points list for BAS integration.

- **EXHAUST KITCHEN HOOD CAPTIVE AIRE DCV KITCHEN CONTROLS BACNET INTEGRATION**

  - System is dedicated to the kitchen exhaust fan and hood.
  - Design intent for retail finishout exhaust fan and hood are to be stand-alone and separate from the base building Captive Aire System. The BAS contract shall coordinate the new Captive Aire DCV system integration to the grease exhaust fan (KEF-20) provide BACnet integration for UNT systems to monitor the entire system.

  - It is the responsibility of the BAS contractor to engage the kitchen controls contractor for full BACnet points list for BAS integration requirements.
KEYED NOTES - RE2.00

1. (1) 1" CONDUIT FOR POWER ROUTED UNDER SLAB TO THE FLOOR DEVICE AND STUBBED UP TO NEAREST FULL HEIGHT WALL. CONTRACTOR SHALL FIELD CONFIRM NEAREST FULL HEIGHT WALL LOCATION. (TYPICAL OF 3.)

2. CONDUIT(S) FOR DATA/IT/AV ROUTED UNDER SLAB TO THE FLOOR DEVICE AND STUBBED UP TO NEAREST FULL HEIGHT WALL. REFER TO TECHNOLOGY PLANS FOR DATA/IT/AV CONDUIT SIZE AND COUNT. CONTRACTOR SHALL FIELD CONFIRM NEAREST FULL HEIGHT WALL LOCATION. ELECTRICAL CONTRACTOR SHALL REFER TO FOODSERVICE SHEET FS5-03 FOR MORE INFORMATION (TYPICAL OF 3.)

3. (1) 1-1/2" CONDUIT FOR POWER ROUTED UNDER SLAB TO THE COUNTER LOAD CENTER AND STUBBED UP TO NEAREST FULL HEIGHT WALL. CONTRACTOR SHALL FIELD CONFIRM NEAREST FULL HEIGHT WALL LOCATION. REFER TO FOODSERVICE DRAWING FOR EXACT LOCATION OF LOAD CENTER.

4. CONDUIT FOR POWER ROUTED UNDER SLAB TO RETAIL PANEL "KPA". REFER TO ARCHITECT FOR EXACT LOCATION OF THE PANEL. REFER TO ONE-LINE ON SHEET E5.01 FOR CONDUIT SIZE AND DISTRIBUTION PANEL THE CONDUIT SHALL BE ROUTED BACK TO.

5. FLOOR BOX WITH QUAD RECEPTACLE FOR MERCHANDISER UNIT. DEVICE SPECIFICATION SHALL MATCH THOSE AT THE "MAIN DINING 100" AREA ON SHEET E2.01. (TYPICAL OF 1.)

6. FLOOR BOX WITH QUAD RECEPTACLE AND DATA FOR CASHIERS STATION. DEVICE SPECIFICATION SHALL MATCH THOSE AT THE "MAIN DINING 100" POS STATIONS ON SHEET E2.01. (TYPICAL OF 3.)
1. Refer to all general notes on sheet RE0.01.
2. Refer to it/data/av/security drawings for additional pull strings. (1) was intended for future retail emergency lighting and (2) were conduit for all devices, including, but not limited to, data devices, ceiling speakers, wireless access points, monitors, etc. Back boxes will not be shown on the electrical plans. It is this contractor's responsibility to refer to the other discipline plans for these devices.
3. Electrical contractor shall refer to foodservice sheet FS5.03 for additional section 11 4000. Electrical contractor shall provide 125A connection to serve the load center. Provide new 125A circuit breaker in panel "Kpa" with 4#1, #6G, 1-1-2"C. All circuit breakers in panel "Kpa" and "E601" shall be lock.
4. Provide power for air curtain. Mechanical contractor shall provide the air curtain with an integral disconnect and electrical contractor shall install. Contractor rough-in. Refer to rm2.01 for location and schedule on RE7.01. Electrical contractor may utilize existing air curtain's conduit, conductors, and/or breaker if height and exact location of each receptacle.
5. Provide power for monitors/tvs at this column. Refer to it/data plans for height of each receptacle.
6. Mechanical contractor is moving this VRH box. Electrical contractor shall extend, C
7. Provide a new 25A / 3P circuit breaker in generator backed up electrical panel as indicated. Provide 4#10, #10G, 3/4"C from the panel to the single point electrical.
8. Provide blank face gfi devices for all shunt trip items under the hood. Label the gfi devices with clear descriptions to alert food service works what they serve.
9. Schedule was copied from kitchen food service sheets on 03/30/21. If there are any discrepancies between the rough schedule, the food service schedule shall govern and the engineer shall be notified.
10. All equipment within island powered from existing.
11. Printhead located on floor.
12. Disconnect and exhaust fan located on roof. Vfd located in retail space.
THIS ELECTRICAL SHEET IS ONLY TO SHOW LIGHT FIXTURE ELECTRICAL CONNECTIONS.

1. PROVIDE POWER AND CONTROL ZONE FOR FUTURE TENANT LIT SIGNAGE. REFER TO LIGHTING DESIGN - TYPE WITH LIGHT FIXTURE MANUFACTURER (RECEPTACLE OR HARD-WIRED CONNECTION) PRIOR TO ROUGH-IN. CONFIRM VOLTAGE (120V OR 277V) WITH MANUFACTURER PRIOR TO ROUGH-IN. REFER TO ARCHITECTURAL PLANS FOR MOUNTING HEIGHT AND LOCATION OF EMERGENCY EGRESS PATH.

2. LIFE-SAFETY EGRESS EMERGENCY FIXTURE. THIS FIXTURE SHALL BE CONNECTED TO BASE retardants. EMERGENCY LIGHTS SHALL BE CONTROLLED WITH ADJACENT LIGHTING VIA UL924 DEVICE. PROVIDE DIMMING TYPE UL924 DEVICE. UL924 DEVICE SHALL MAKE LIGHT TO COME ON TO INDICATED LIGHTS INDICATED SHALL BE CIRCUITED TO THIS CIRCUIT UNLESS INDICATED OTHERWISE.

3. REFER TO ARCHITECTURAL PLANS AND ELEVATIONS FOR EXACT FIXTURE LOCATION IN SHELVING OR COUNTER (TYPICAL).

4. REFER TO ARCHITECTURAL NOTES ABOUT THE EXACT LOCATIONS OF SPOTLIGHT FIXTURES NEAR THE SHELVING. CONTRACTOR TO MOCKUP FIXTURE LOCATIONS IN CONSTRUCTION AND ADJUST THEM PER PHYSICAL OWNER REVIEW DURING CONSTRUCTION.
A. S&C - CAMPUS STANDARD FOR MEDIUM VOLTAGE GEAR, ALTERNATES MUST BE APPROVED BY ANY DISTRIBUTION EQUIPMENT SUBMITTAL WILL NOT BE REVIEWED

B. EXISTING CONDITIONS ARE BASED ON INFORMATION PROVIDED BY SITE SURVEY AND RECORD SUBMITTED AT THE SAME TIME OR BEFORE THE EQUIPMENT SUBMITTAL. PROVIDE DRAWINGS. HOWEVER, IT IS NOT INTENDED TO BE AN EXACT REPRESENTATION OF ACTUAL CONDITIONS. ELECTRICAL CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS (WHICH INCLUDE EXISTING DINING HALL: 60A FUSE EXISTING BUSINESS LEADERSHIP ANY ELECTRICAL EQUIPMENT. ELECTRICAL CONTRACTOR SHALL ALSO FIELD VERIFY PANELBOARDS DESIGN. ELECTRICAL CONTRACTOR SHALL VISIT JOB SITE PRIOR TO BIDDING TO ASCERTAIN EXISTING CONDITIONS AND SHALL NOTIFY ARCHITECT OF ANY DISCREPANCIES PRIOR TO BID.

C. TRANSFORMERS SHALL HAVE COPPER WINDINGS.

D. PROVIDE FULL HEIGHT VERTICAL BUS FOR ALL SWITCHBOARDS, DISTRIBUTION BOARDS AND PANELBOARDS.

E. TRANSFORMERS SHALL HAVE COPPER WINDINGS.

F. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE SELECTION OF OVERCURRENT/SHORT CIRCUIT PROTECTIVE DEVICES BASED ON CALCULATED PROSPECTIVE FAULT ENERGY AT EACH MANHOLE, THEN TO NEW TRANSFORMER FOR DINING BUILDING. DUCT WILL BE TYPE DB GALVANIZED RIGID STEEL ELBOWS TO PREVENT DAMAGE DURING CABLE INSTALLATION.

G. CONTRACTOR SHALL ALSO COMPLY WITH UNT TECHNICAL DESIGN GUIDELINES.

H. NEW PORTABLE GENERATOR GENERATOR SHALL BE SIZED TO HAVE A CAPACITY OF AT LEAST 1300A AT 277/480V, 3PH, 4W. CONTRACTOR SHALL VISIT JOB SITE PRIOR TO BIDDING TO ASCERTAIN EXISTING CONDITIONS AND SHALL NOTIFY ARCHITECT OF ANY DISCREPANCIES PRIOR TO BID.

I. CONTRACTOR SHALL BE RESPONSIBLE FOR FOLLOWING ALL UNT CONDITIONS. THE CONTRACTOR SHALL VISIT THE SITE BEFORE BIDDING. THE CONTRACTOR'S DESIGN BUILD BID SHALL ALSO INCLUDE A DISCONNECTING MEANS, NEW MTS, AND NEW PORTABLE GENERATOR PROVISION FEASIBLE DURING A SITE VISIT PRIOR TO BIDING.

J. These drawings have been prepared as one coordinated set of drawings and are complimentary. What is required by one component part is not identified on every sheet. Any user's reliance on a single or select few sheet(s) of the drawings than 2 INCHES THICK. CONTRACTOR SHALL ALSO COMPLY WITH UNT TECHNICAL DESIGN GUIDELINES.
**Lighting Fixture Schedule - Retail**

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<th>Description</th>
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<th>Size</th>
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<th>Quantity</th>
<th>Notes</th>
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<tr>
<td>4 INCH - RECESSED DOWNLIGHT - 1500 LUMEN - BLACK FLANGED</td>
<td>LITHONIA EVO4/15</td>
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**Mechanical Equipment Feeder Schedule - Retail**

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**Panelboard: KPA**

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<tbody>
<tr>
<td>170 A</td>
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<td></td>
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</table>

**Panelboard: E601**

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Size</th>
<th>Color</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>170 A</td>
<td></td>
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**Total Amps:**

<table>
<thead>
<tr>
<th>Load Classification</th>
<th>Connected Load</th>
<th>Demand Factor</th>
<th>Estimated Demand</th>
<th>Panel Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>1745 VA</td>
<td>100.00%</td>
<td>1745 VA</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0 VA</td>
<td>0.00%</td>
<td>0 VA</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- ALL CIRCUIT BREAKER IN THIS PANEL SHALL BE LOCK-OUT TYPE.
- *= INDICATES THE BREAKER SHALL ALSO BE GFI TYPE.

---

**General Notes:**

- A CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL ACCESSORIES FOR PR OPER MOUNTING OF FIXTURES IN SPECIFIC CEILING PER LOCATION OF FIXTURES.
- BATTERIES, BALLASTS, AND LAMPS SHALL HAVE 5 YEAR, 5 YEAR, AND 1 YEAR WARRANTY PERIOD, RESPECTIVELY.
- PROVIDE 10 EXTRA LAMPS FOR EVERY 100 FOR EACH TYPE AND RATING OF LAMP INSTALLED. FURNISH AT LEAST 2 OF EACH TYPE. PROVIDE WITH PROTECTIVE COVERING FOR STORAGE AND CLEARLY LABEL CONTENTS.
- PROVIDE PRODUCTS BY ONE OF THE FOLLOWING MANUFACTURERS - ADVANCE, MAGNETECK, OSRAM/SYLVANIA, OR MANUFACTURER'S STANDARD.
- PROVIDE 120V CONTROLS CIRCUIT TO EACH 120V/24V CONTROLS TRANSFORMER (TRANSFORMER BY MECHANICAL CONTRACTOR). EACH TRANSFORMER SHALL BE VISUALLY AND ACOUSTICALLY CONCEALED.

---

**Electrical Schedules - Retail**

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Size</th>
<th>Color</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>170 A</td>
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**Panelboard: KPA**

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<tbody>
<tr>
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**Panelboard: E601**

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</tbody>
</table>
PLUMBING INSULATION SCHEDULE

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>TEMP. RANGE</th>
<th>MATERIAL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PLUMBING GENERAL NOTES:

1. All steel, copper, and plastic piping shall be arranged to facilitate accessibility for maintenance, repair, and replacement. All piping shall be labeled with material identification and size.
2. All faucet supply lines, waste and drain lines, and vent lines shall be insulated with foam rubber insulation.
3. All water supply lines shall be insulated with foam rubber insulation. The insulation shall be a minimum of 1" thick.
4. All drain and vent lines shall be insulated with foam rubber insulation. The insulation shall be a minimum of 1" thick.
5. All heating and cooling lines shall be insulated with foam rubber insulation. The insulation shall be a minimum of 1" thick.

PLUMBING INSULATION SCHEDULE

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PLUMBING/STRUCTURAL COORDINATION:

1. All plumbing and structural members shall be coordinated to facilitate accessibility for maintenance, repair, and replacement.
2. All plumbing and structural members shall be labeled with material identification and size.

PLUMBING DESIGN CRITERIA

<table>
<thead>
<tr>
<th>PIPE</th>
<th>MATERIAL</th>
<th>SIZE</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Steel</td>
<td>1/2&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>B</td>
<td>Copper</td>
<td>3/4&quot;</td>
<td>1.5&quot;</td>
</tr>
<tr>
<td>C</td>
<td>Plastic</td>
<td>1&quot;</td>
<td>2&quot;</td>
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<tr>
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<td>Plastic</td>
<td>1&quot;</td>
<td>2&quot;</td>
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</table>
EXISTING SANITARY PIPING INSTALLED IN SHELL SPACE. FIELD CONFIRM.

ROUTE DOMESTIC AND SOFT WATER PIPING UNDERFLOOR TO FOOD SERVICE ISLAND. COORDINATE WITH CROSSING GREASE WASTE PIPING.

4"ø SAN UP

3"ø SAN UP

3" FD W/TG

3/4" ø DCW UP

1/2" ø SOFT UP

2" ø SAN UP

2" ø V UP

3" ø GW

4" ø SAN

4" ø GW

6" ø GW
APPLICABLE CODES, BUT DIV. 22 TO PIPE WHEN NOT PREPIPED BY FACTORY. INTERCONNECT THRU WATERFILTER TO DIVISION 22. VACUUM BREAKERS, WHEN FURNISHED WITH EQUIPMENT, SHALL OVERRIDE ABOVE, IF ACCEPTABLE WITH EQUIPMENT WHERE BACKFLOW AND/OR BACKSYPHONAGE MAY OCCUR AND WHERE A MINIMUM AIR GAP CANNOT BE PROVIDED. PROTECTIVE DEVICES TO PROTECT AGAINST BACK FLOW. BACK SYPHONAGE SHALL BE INSTALLED AT ALL FIXTURES AND ALL PIPING WITHIN COUNTER BODY OR UNDER FABRICATED COUNTERS TO BE RUN TO A CONNECTION POINT BELOW COUNTER. ALL EXHAUST HOOD CONNECTIONS AND CONDENSATE CONNECTIONS FURNISHED INSTALLED BY DIVISION 22.

DRAINAGE AND PIPING SYSTEMS TO BE CLEANED PRIOR TO FINAL CONNECTION WITH FOODSERVICE EQUIPMENT.

FROM THIS DRAWING. REFER TO THE FOODSERVICE EQUIPMENT SUPPLIER’S DIMENSIONED SHOP DRAWINGS.

CONTRACTOR IS ONLY RESPONSIBLE FOR THE SOFT WATER SYSTEM NOTED/SHOWN, AND NO LOCAL FILTRATION UNITS.

HAND WASHING TO PREVENT SCALDING. NO MIXING VALVES ARE BEING PROVIDED BY THE FOOD SERVICE CONTRACTOR.

PLUMBING CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL LOCAL MIXING VALVES AT ALL SINKS THAT COULD BE USED FOR WASHING.
NOT TO SCALE

8 FIRE RATED PIPE SLEEVE DETAIL

PIPE AT BOTH SIDES OF WALL

SAFING AROUND PERIMETER OF THROUGH WALL PIPE PASSING STEEL DECK INSIDE INSULATION OR OTHERWISE PENETRATE VAPOR BARRIER. DO NOT HANG ONE PIPE FROM PROVIDE UPPER ATTACHMENT AS REQUIRED FOR CASES NOT SHOWN HERE. DO NOT INSTALL HANGER AT BOTTOM OF JOIST. FOR PIPING FOUR BAND HANGER CLAMP IF STEEL TOP BEAM C-IRON OR STEEL IS NOT ACCEPTABLE. REFER TO CODES FOR FURTHER INFORMATION. PROVIDE SEISMIC BRACING IF/AS REQUIRED BY LOCAL AUTHORITIES. CHAINS OR PERFORATED STRAP STEEL STRUTS BETWEEN JOISTS IF REQUIRED. LOCATE HANGERS TO TAKE LOAD OFF EQUIPMENT.

STEEL DECK

LARGER THAN 3" FROM

DO NOT HANG PIPE FOR PIPING FOUR

BAND HANGER

INSULATION THICKNESS WHEN SIZING INSULATED PIPE LARGER THAN 3/4". VERIFY PROVIDE GALVANIZED STEEL SADDLE FOR ALL WALLS IN SMOKE TIGHT MANNER AND SEAL OR CAULK SLEEVES THRU FIRE WALL. IF/WHEN NECESSARY, INSTALL PIPE SUPPORTS COMPLETELY COVER OPENING FLUSH BY LOCAL CODES. (25 GA. SPLIT WALL CORE DRILL ROOF OR DECK BETWEEN PIPE AND FLASHING AND COORDINATE INSTALLATION OF FLASHING AND ROOF INSULATION)

BARE COPPER PIPE NON-METALLIC PROVIDE COPPER OR FOR PIPE SLOPE HANGERS.

PIPE SIZE VARIES (3/4" - 3"") OF TYPE OF ROOF DECK PROVIDE SLEEVE IF REQUIRED 

PER 2015 IECC SEC. C404.5.1 MAXIMUM ALLOWABLE TO PUBLIC LAVATORY FAUCET MUST BE 24" OR LESS TO SPECIFICATIONS FLOOR SINK, REFER FLOOR 'P' TRAP

SMALLER VENT IF/WHERE PROVIDE PIPE INCREASER ON ROOF INSULATION

WALL.

FLOOR, IF NO NEARBY MOUNTED TO WALL OR PROVIDE STANDOFF GREATER) ABOVE THE (WHICHEVER IS MAINTAIN AIR GAP. TWO SMALLER VENT IF/WHERE PROVIDE PIPE INCREASER ON ROOF INSULATION

WALL.

FLOOR, IF NO NEARBY MOUNTED TO WALL OR PROVIDE STANDOFF GREATER) ABOVE THE (WHICHEVER IS MAINTAIN AIR GAP. TWO SMALLER VENT IF/WHERE PROVIDE PIPE INCREASER ON ROOF INSULATION

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WALL.
These drawings have been prepared as one coordinated set of drawings and are complimentary. What is required by one drawing is required by all of the drawings, even if a detail or component part is not identified on every sheet. Any user’s reliance on a single or select few sheet(s) of the drawings without consideration for the information included in the entire set of drawings will be at the user’s sole risk and shall not form the basis for a request for additional compensation or time.
PLUMBING / MECHANICAL NOTES

1. DO NOT ROUGH-IN FROM THIS DRAWING. REFER TO CONTRACTORS DIMENSIONED DRAWINGS.
2. DIMENSIONS INDICATED ARE TO BE VERIFIED BY CONTRACTOR AND ADJUSTED AS REQUIRED BY
   EQUIPMENT OR FIELD CONDITIONS.
3. ACCESSORIES AND FITTINGS PROVIDED LOOSE WITH FOODSERVICE EQUIPMENT BY SECTION
   11400. FIELD INSTALLED BY DIVISION 22.
4. SERVICE SINK BY DIVISION 22.
5. DRINKING FOUNTAIN BY DIVISION 22.
6. FLUSHING OUT OF ALL PIPING AND DRAINAGE SYSTEMS PRIOR TO CONNECTION OF
   FOODSERVICE EQUIPMENT BY DIVISION 22.
7. FIRE HOSE CABINET AND SPRINKLER SYSTEMS BY DIVISION 22.
8. VENTILATE WAREWASH AND UTENSIL WASH ROOMS IN ADDITION TO MACHINE
   REQUIREMENTS INDICATED ON MECHANICAL CONNECTIONS DRAWINGS.
9. PIPE SLEEVES IN STRUCTURE FOR REFRIGERANT LINES, GAS LINES, ETC., BY DIVISION 25.
10. LOCATIONS INDICATED ON CONTRACTOR'S SUBMITTAL DRAWINGS.
11. VENTILATE REFRIGERATION MACHINERY ROOM TO PROVIDE 95 deg F AMBIENT TEMPERATURE.
12. VENTILATE DRY STORAGE ROOM TO PROVIDE 70 deg F AMBIENT TEMPERATURE.
13. WATER AND GREASE-PROOF EXHAUST DUCTS FROM VENT CONNECTIONS OF EXHAUST HOODS BY DIVISION 25.
BUILT REMOTE PULL STATIONS FOR EXHAUST HOODS:

- Empty octagonal box at 48" AFF with 3/4" diameter electrical panel board by Division 26.
- Wall switch, concealed conduit and wiring to exhaust fan(s) by Division 26.
- Intercom/telephone by Division 26.
- Verify all electrical characteristics with architect's engineering drawings.
- Dr, sr, or ds as indicated on drawing: furnished and prewired to JB or load center by Section 11 40 00, do not rough dimensions indicated are to be verified by contractor and adjusted as required by foodservice.
- Evaporator coil prewired to JB mounted on compartment top by Section 11 40 00, final connection by electric drinking fountain, not by Section 11 40 00.

Accessories and fittings provided loose with foodservice equipment by Division 11, field installed by.

Contactor relays at panel board by Division 26 for fuel shut disposer control panel mounted undercounter or as indicated in drawings by Section 11 40 00.

E605
- Intercom/telephone by Division 26.
- Verify all electrical characteristics with architect's engineering drawings.
- DR, SR, or DS as indicated on drawing: furnished and prewired to JB or load center by Section 11 40 00, final connection by Division 26.

- Do not rough dimensions indicated are to be verified by contractor and adjusted as required by foodservice.

Refer the following notes to "hex" symbols indicated on "FS" electrical connections drawings:

1. Do not rough-in from this drawing. Refer to the contractors' engineering drawings.
2. Verify all electrical characteristics with architect's engineering drawings.
3. Equipment and outlets indicated are to be verified by contractor and adjusted as required by foodservice.
4. Access panels and fittings provided loose with foodservice equipment by Division 26, final installed by contractor.
5. Electrical panel board by Division 26.
8. Closet, not by Section 11 40 00.
9. Time clocks/drawers not by Section 11 40 00.
10. Electric drinking fountain, not by Section 11 40 00.

**Electrical Notes**

- See承包商的详细图纸上的内容。
- 所有电气设备的安装和调整应符合食品服务的需要。
- 电饮用水喷泉，不按第11 40 00节安装。
- 每一个组件在图纸上都有标识。任何使用者都应按照整个图纸上的信息来参考，而不应仅依赖于单一或少数几张图纸。
- 这些图纸已被准备成一套协调的图纸，用于承包商的电气连接。
LEGS WITH CLOSED ENDS BETWEEN EACH PAIR OF AT CENTER OF TOP AND 1" X 4" X 12 GAUGE NO. A20-0206 GUSSET FULLY WELDED COMPONENT HARDWARE MODEL 2'-0" o.c. MAXIMUM. PAINTED WITH GALVANIZED STEEL ANGLE AT NO. A20-0206 GUSSET FULLY WELDED MADE-UP TIGHT, BRINGING TOP DOWN SNUGLY ON ANGLE FRAME ELEMINATING LOCKWASHER & CAPNUTS. STUDS SUCH LENGTH THAT CAPNUTS CAN BE ALL VIBRATIONS OR ‘OIL CANNING’ 1/4" STUDS WELDED 9" o.c. MAXIMUM WITH CHROME PLATED WASHER TOP TURN-DOWN CLOSE ENDS TO THE 14 GAUGE NO. 4 FINISH STEEL “ZEE” CLIPS ANCHORED TO THE WITH 4" LONG 14 GAUGE STAINLESS SECURE SPLASH TURN-DOWN TO WALL 2½" OR AS REQUIRED CATCH OFFSET LOWER HORIZONTAL FRAMING MEMBER MODEL NO. M75-1002 COMPONENT HARDWARE M27-2490 SPRING INSULATION DOUBLE PAN DOOR CONSTRUCTION SHEET TITLE FOODSERVICE EQUIPMENT DETAILS PROJECT ADDRESS UNIVERSITY OF NORTH TEXAS DENTON - RETAIL Scale : 1 1/2" = 1'-0" PREPARATION COUNTER AT SINK SECTION SCALE : HALF SIZEHOSE BIBB BRACKET DETAIL SCALE : HALF SIZERAIN HANDLE BRACKET DETAILSCALE : NONESQUARE EDGE DETAIL FOOT DETAIL SCALE : HALF SIZE Where required, furnished 3/4" PLYWOOD BLOCKING, 3/4" TIGHT 1 2 4 5 3 1 2 4 5
These drawings have been prepared as one coordinated set of drawings and are complimentary. What is required by one drawing is required by all of the drawings, even if a detail or component part is not identified on every sheet. Any user's reliance on a single or select few sheet(s) of the drawings without consideration for the information included in the entire set of drawings will be at the user's sole risk and shall not form the basis for a request for additional compensation or time.

KITCHEN EXHAUST HOOD REQUIREMENTS:

1. Height: The exhaust hood shall extend above the equipment area to provide proper ventilation.
2. Hood Type: The exhaust hood shall be designed for the specific equipment it is serving.
3. Hood Size: The size of the exhaust hood shall be determined by the equipment's ventilation requirements.
4. Hood Location: The exhaust hood shall be installed in a location that allows for proper ventilation and access for maintenance.

ASSEMBLY INSTRUCTIONS:

- Assembly shall be performed in accordance with the manufacturer's instructions.
- All components shall be assembled in their designated locations.
- All fasteners shall be tightened to the manufacturer's specifications.
- All connections shall be made securely to ensure proper functionality.

FOR QUESTIONS CALL:
HOUSTON SALES OFFICE
BRANDON AYERS - GERARDO VALDEZ - CESAR GARCIA
PHONE: 866-437-0700
EMAIL: REG46@CAPTIVEAIRE.COM

© 2018 Kirksey
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The work detailed by these specifications and drawings has been specified to meet certain requirements for performance. Some coordination with all trades and Owner representatives as required facilitating the installation of the control system equipment.

The contractor shall provide all materials, equipment, labor and all other incidental material, tools, appliances and transportation required for the installation of the systems as detailed herein, including but not limited to:

- All audiovisual cables placed in ceiling cable tray must be labeled with adequate labeling materials, fasteners, hangers and brackets as required.
- Coordination with other trades (framing, electrical, etc.) and requires coordination from the General Contractor.
- General elements of the work shall consist of but not be limited to:
  - All audiovisual outlets in conduit, cable tray, and or junction boxes must be labeled.
  - Audiovisual cable shall not be painted.
  - Ceiling received distributed loudspeakers.
  - Future flat panel displays (televisions).

## Audiovisual Drawings Index

**Audiovisual Symbol Legend**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Power Requirements</th>
<th>Data Requirements</th>
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<tbody>
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<td>CEIL</td>
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<td>NA</td>
<td>NA</td>
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<td>NA</td>
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<tr>
<td>FUTURE FLAT PANEL DISPLAY (TV/SCREEN)</td>
<td>Future flat panel display (television).</td>
<td>SOURCE DISPLAY OUTLET</td>
<td>2 DATA</td>
<td>NA</td>
<td>“Audio Visual Details” Sheet</td>
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</tbody>
</table>

## General Notes

The architectural plans and specifications, general conditions, supplementary general conditions and other supplementary conditions and specifications may apply to this work.

The contractor shall, carefully examine the plans to determine the extent of work and condition under which the work is to be performed. The contractor is required to make a complete set of project drawings and specifications and the need for any additional drawings or specifications should be brought to the attention of the Contractor.

Invoices should be submitted between the documents listed above. The most straightforward specifications shall apply.

The contractor shall provide all materials, equipment, labor and all other incidental material, tools, appliances and transportation required for the installation of the systems as detailed herein, including but not limited to:

- Maintaining construction materials and refuse within the area of work.
- Procure all permits and license required to complete this installation.
- Preparation of O&M manuals and as built documentation.
- Providing warranty service for a period of one year from final completion date and include (2) maintenance visits at 6 month intervals to be completed prior to the end of the warranty period.
- Make final adjustments, calibrations and programming modifications as directed by the Owner and Consultant.
- Demonstrate all systems for final acceptance.

This sheet includes a responsibility matrix for all AV and Audiovisual trades. Each AV element has a corresponding deliverable, which is the responsibility of a specific trade.

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## General Notes

The architectural plans and specifications, general conditions, supplementary general conditions and other supplementary conditions and specifications may apply to this work.

The contractor shall, carefully examine the plans to determine the extent of work and condition under which the work is to be performed. The contractor is required to make a complete set of project drawings and specifications and the need for any additional drawings or specifications should be brought to the attention of the Contractor.

Invoices should be submitted between the documents listed above. The most straightforward specifications shall apply.

The contractor shall provide all materials, equipment, labor and all other incidental material, tools, appliances and transportation required for the installation of the systems as detailed herein, including but not limited to:

- Maintaining construction materials and refuse within the area of work.
- Procure all permits and license required to complete this installation.
- Preparation of O&M manuals and as built documentation.
- Providing warranty service for a period of one year from final completion date and include (2) maintenance visits at 6 month intervals to be completed prior to the end of the warranty period.
- Make final adjustments, calibrations and programming modifications as directed by the Owner and Consultant.
- Demonstrate all systems for final acceptance.

This sheet includes a responsibility matrix for all AV and Audiovisual trades. Each AV element has a corresponding deliverable, which is the responsibility of a specific trade.

### Audiovisual Symbol Legend

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Power Requirements</th>
<th>Data Requirements</th>
<th>Consult Requirements</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIL</td>
<td>Ceiling received distributed loudspeaker.</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>FUTURE FLAT PANEL DISPLAY (TV/SCREEN)</td>
<td>Future flat panel display (television).</td>
<td>SOURCE DISPLAY OUTLET</td>
<td>2 DATA</td>
<td>NA</td>
<td>“Audio Visual Details” Sheet</td>
</tr>
<tr>
<td>SYMBOL</td>
<td>DESCRIPTION</td>
<td>MAKE</td>
<td>MODEL</td>
<td>NOTES</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>DSP BIAMP</td>
<td>TESIRA FORTE AI</td>
<td>DIGITAL SOUND PROCESSOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>AMP QSC</td>
<td>CXD4.3</td>
<td>AUDIO AMPLIFIER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>JBL CONTROL 47 C/T</td>
<td>70V OVERHEAD SPEAKER</td>
<td>OBTAIN COUNT FROM PLAN. PAINT SPEAKER AND GRILL TO MATCH CEILING FINISH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AV Rack (Room 106):**

- **VGA Out:**
- **Audio In:** 70V OUT
- **AMP Output CH 1:** 5 IN USE
- **Existing Equipment:**

<table>
<thead>
<tr>
<th>SHEET NUMBER</th>
<th>SHEET TITLE</th>
<th>PROJECT NAME</th>
<th>PROJECT ADDRESS</th>
<th>DATE ISSUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA6.04</td>
<td>FOODSERVICE AUDIO VISUAL SCHEMATIC</td>
<td>UNIVERSITY OF NORTH TEXAS DENTON - RETAIL</td>
<td>1416 MAPLE ST. DENTON, TX 76201</td>
<td>5 APR 2021</td>
</tr>
</tbody>
</table>
GENERAL NOTES
1. THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS AND OTHER REQUIREMENTS OF DIVISION 1, THE ELECTRICAL SERVICE, ALL INSTALLATION REQUIREMENTS AND ALL RELATED DRAWINGS FOR THIS PROJECT ARE APPLICABLE.
2. COMMUNICATIONS CABLING INSTALLATION MUST BE PERFORMED IN ACCORDANCE WITH ALL STANDARD INDUSTRY REQUIREMENTS AND LOCAL CODES. IN ADDITION, ALL PLANNING AND INSTALLATION SHALL BE CONDUCTED IN SUCH A MANNER AS TO NOT ALTER OR DISTURB STRUCTURED CABLING SYSTEMS AND FURNISHINGS, ELECTRICAL OR OTHER SYSTEMS EXISTING ON SITE.
3. THE CONTRACTOR SHALL CAREFULLY ENSURE THE SITE TO BE FREE OF HAZARDOUS CONDITIONS PRIOR TO BEGIN WORK. COMMUNICATIONS CABLING SYSTEMS SHALL NOT BE ALTERED OR DISRUPTED AFTER INSTALLATION.
4. THE GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS AND ALL RELATED DRAWINGS FOR THIS PROJECT ARE APPLICABLE.

GROUNDING AND BONDING
1. ALL METAL RACKS, FRAMES, CABINETS AND MISCELLANEOUS ITEMS MUST BE BONDED TOGETHER TO FORM A SINGLE AC POTENTIAL. ALL EQUIPMENT, STRUCTURED CABLING RACKS ARE AT THE SAME GROUND POTENTIAL. A VOLT-O-METER (VOM) MEASUREMENT BETWEEN ANY TWO POINTS ON THE STRUCTURED CABLING SYSTEM SHOULD NOT EXCEED 2 VOLTS DC OR AC POTENTIAL.
2. ALL GROUNDS USED SHALL BE BONDED TOGETHER TO FORM A SINGLE GROUND BUS BAR. ANY SURFACE TO BE GROUNDED MUST BE FREE OF PAINT OR OTHER COATING THAT MIGHT PREVENT AN EFFECTIVE GROUND. PAINT SHOULD BE SCRAPED AWAY UNTIL METALLIC SURFACE HAS BEEN EXPOSED.
3. ALL WALLS AND CEILINGS MUST BE ROUTED IN COMPLIANCE WITH MIS/CABINET INSTALLATION REQUIREMENTS. WALL BOXES AND BACK BOXES SHALL BE INSTALLED ON WALLS AND CEILINGS.

COMMUNICATIONS CABLE
1. CONTRACTOR SHALL PROVIDE AND INSTALL HORIZONTAL COPPER DATA CABLES.
2. HORIZONTAL DATA CABLES SHALL CONSIST OF 24 AWG PLENUM CAT 5E IMMERSIBLE BLINDMINE UTP CABLES TO EACH USER LOCATION.
3. WIRELESS AND SECURITY DATA CABLING SHALL TERMINATE ON SEPARATE DATA CABLE PATCH PANELS.

INDEX OF DRAWINGS
- TOPICS
  - TELECOM INDEX
  - TN:00 TELECOM INDEX
  - TN:23 ENLARGED PLAN - DATA CENTER TELECOM PLAN
  - TN:34 ENLARGED PLAN - FOOD SERVICE TELECOM PLAN
SECURITY SYMBOL LEGEND

SECURITY NOTES

1. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL ALL ACCESSORIES REQUIRED FOR SPECIFIED POWER AND RECEPTACLE REQUIREMENTS IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS AND DRAWINGS AND VERIFY AGAINST SECURITY SPECIFICATIONS AND DRAWINGS. REPORT TO GC ANY DISCREPANCIES PRIOR TO PURCHASE OR INSTALLATION.

2. ELECTRICAL CONTRACTOR SHALL INSTALL normal and enhanced power supply as required for panel board(s) supplying electrical power to security equipment. Ensure that power supplied is continuous and sufficient for all security equipment.

PROJECT NOTES

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1.1.2 SECURITY INDEX

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